THE WELDING ENGINEER

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COVER: *"Salute to Alloy Steel," theme of the 1948 Metal Congress and Exposition, inspired this choice of cover picture. The giant ingot molds are enroute to the stripper at the South Works of Carnegie-Illinois Steel Corp. Photo courtesy U. S. Steel Corp.*

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7 INDUSTRIAL MODELS

Model	Welding Range Amps.	Primary Volts	Electrode Sizes	Cabinet Dimensions	Rating (Amps.)
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200 RP	25-285	220/440	5/32-1/4	32x21x37½"	200
300 RP	25-450	220/440	5/32-1/4	32x21x37½"	300
400 RP	25-520	220/440	5/32-5/16	32x21x37½"	400
500 RP	25-700	220/440	5/32-3/8	32x21x37½"	500
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All Standard Models (Except 200 R, 750 RP and 1000 RP) have Built-In Automatic Voltage Reducer.
All RP Models have Built-In Power Factor Correction.

5 SHOP MODELS

Model	Welding Range Amps.	Primary Volts	Electrode Size	Cabinet Dimensions	Rating (Amps.)
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20 G	20-190	220	1/16-3/16	18½x18x35¼"	150
20 GP	20-190	220	1/16-3/16	18½x18x35¼"	150
30 G	25-260	220	1/16-1/4	18½x18x35¼"	200
30 GP	25-260	220	1/16-1/4	18½x18x35¼"	200

All GP Models have Built-In Power Factor Correction.

ESTABLISHED 1916

THE WELDING ENGINEER

OCTOBER 1948

About Convention Headaches

ALL WORK and no play makes Jack a dull boy, but all play and no work makes headaches, hangovers and a wholly wasted convention.

Fortunately, indications are that this year's convention of the American Welding Society in Philadelphia will be accompanied by less horseplay than some of the meetings in the past. The picnic is over so far as many industrial organizations are concerned. In these days of higher and ever higher costs, management has grown tired of paying high-salaried employees to make fools of themselves at out-of-town conventions.

From now on, the acquisition of new knowledge will be the most important task of the convention delegate. Fun is fun, but it will have to be kept in line. True, most of your evenings are free, and your company isn't going to expect you to spend them in your hotel room reading the Gideon Bible. But neither are you expected to be running around half the night trying to drink Philadelphia dry. And putting it all on the swindle sheet under the guise of "entertainment."

Of course, you aren't one of those hell-raisers whose noise and generally disorderly conduct does so much to spoil things for other visitors. That's a good thing—for you. Most bosses appear to have become tired of contributing to the delinquency of employees by footing big bills for meeting expenses. The hell-raisers will be left at home.

The psychology of it is easy to understand. Once away from the wife and kids, a man is apt to feel that he is entitled to let off a little steam. That's only natural, but don't let off too much or the convention will wind up in a big headache—both literally and figuratively.

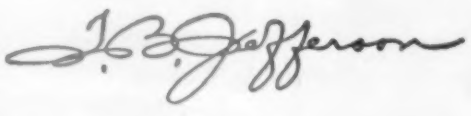
Sure, cut loose and have a time for yourself provided that you can do it and still remain within bounds. But when you stay up so late at night that you miss the morning sessions —or attend them with body only—you are neglecting a wonderful opportunity to acquire valuable information.

This year the AWS is presenting a program of 68 papers in 21 technical sessions (see page 62). The comprehensive program covers a wealth of welding information. There are papers on welding and related processes as used in very nearly every manner that anyone might seek to use them. And if the precise point in which you are interested isn't touched upon by the speakers, ample opportunity is provided for you to ask questions.

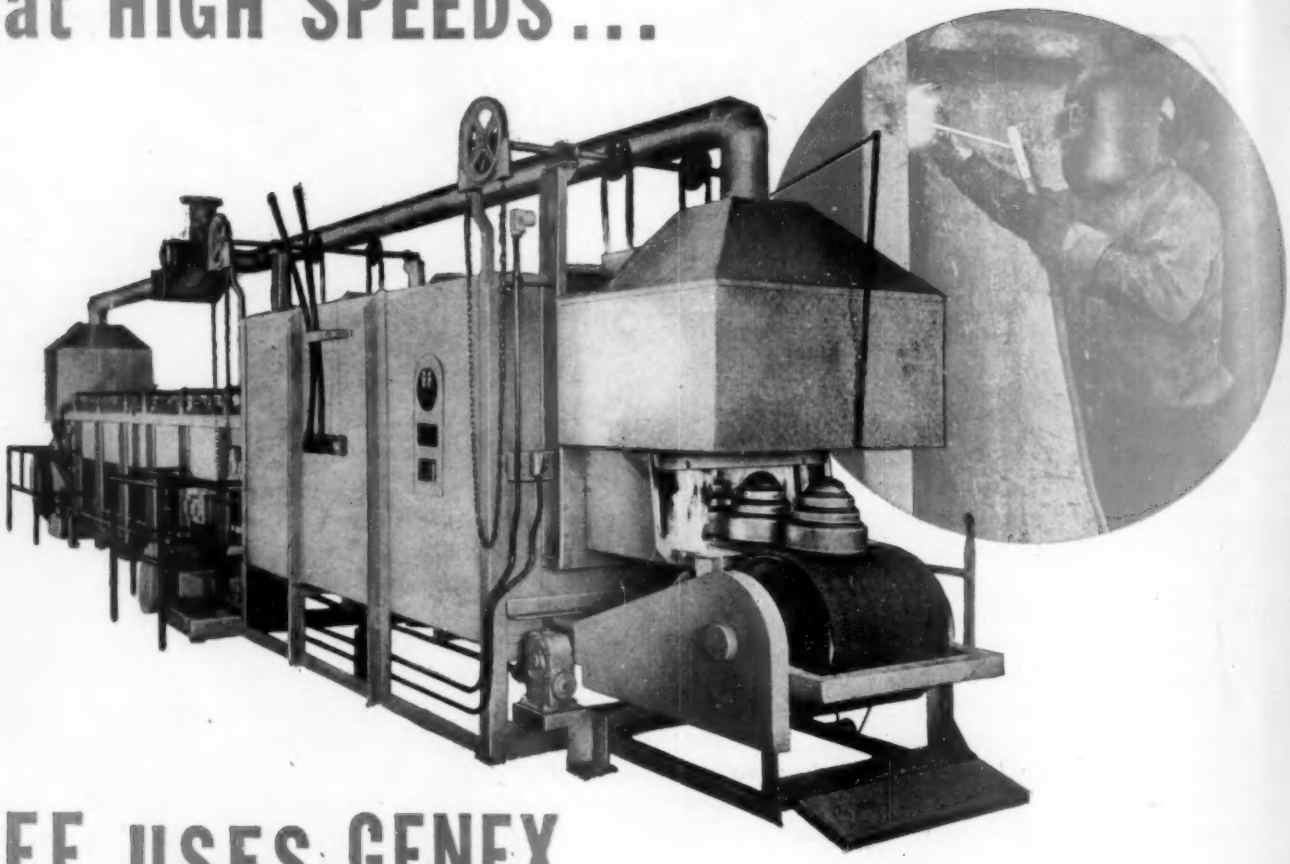
Additional knowledge may be gained from viewing the welding and cutting exhibits at the Metal Show. An alert mind is all you need to be brought up-to-date on latest techniques and newest processes. It's all free for the listening and the looking. Why pass it up?

The time in Philadelphia is yours to spend wisely or foolishly. Spend it foolishly, and you lose it forever. Money you waste may be replaced out of future income, and you need not suffer. But wasted time can never be regained. Each of us is allotted only a limited amount of years, days, hours and minutes, and it's our job to get all we can out of them.

Let's start at Philadelphia!



For GAS TIGHT WELDS at HIGH SPEEDS...



EF USES GENEX

WELDS in the heating and cooling chambers of special atmosphere electric furnaces must be gas tight to prevent infiltration of air and escape of the protective gases used in heat treating, bright annealing, brazing and other processes.

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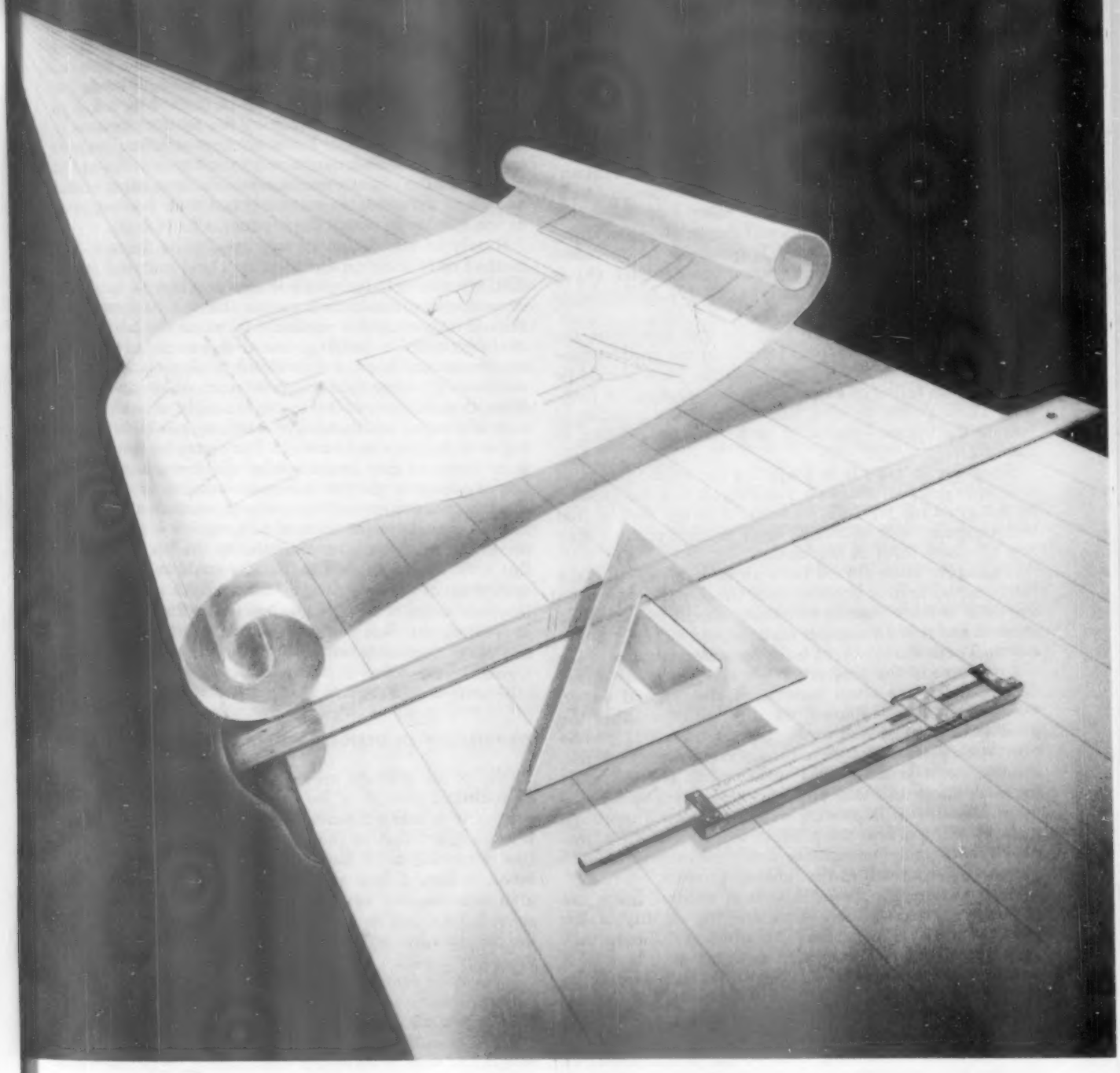
DESIGN FOR WELDING



When welding is incorporated in a design, a stronger, lighter, more pleasing product results. The welded product is often less costly, too. A variety of product designs illustrate these points.

BY T. B. JEFFERSON, M.E.

MUCH OF THE BASIC DESIGN of a new product comes from an understanding of proved design techniques. Some authorities say that a new design is based 90% on the application of well proved engineering design practices and 10% original thinking on the part of the designer. Where welded design is under consideration, one sometimes wonders if there is 10% original thinking in the approach of a new design problem.

WHAT DESIGNERS SHOULD KNOW

When called upon to find the best possible answer within the limits of his ability, the designer must look into all of the factors to be considered as he undertakes the new design. This means that when he is delegated a design problem he should know the answers to such questions as: (1) How soon is the product needed? (2) What quantities are to be produced? (3) Is cost of production a serious consideration? (4) Is overall weight an important factor? (5) Is there a likelihood of design changes during production or operation? (6) Is quietness in operation important? (7) Is rigidity or strength essential? (8) Is appearance a factor of consideration? (9) Is flexibility in manufacture an advantage?

An analysis of the factors above will determine the most advantageous materials for use on the product concerned and ascertain whether the metal parts should be formed from rolled or extruded shapes, castings or forgings. These points decided, there follows the question of joining the metals – should it be by bolting, riveting or welding.

Since our concern is in designing for welding, it is, of course, hoped that someone will suggest that the product be designed for welding because "it is the feeling that welded design will result in a more reliable product than any alternate form of fabrication."

A designer must always have an understanding of the fundamental factors entering into the job. This involves a great deal more than merely being able to calculate the stresses and select a suitable material and means of fabrication. There should be, at least, an understanding of the ultimate use of the product. When the job is one of redesign, there are often features of the original design which must be maintained, irrespective of whether the product is to be of welded design or fabricated by some other means. Such factors naturally restrict the designer, but they must be accepted as fundamental. There is nothing more dangerous than an otherwise good designer who takes pleasure in improving details without a thorough understanding of how the product will be used. The "improvements" may necessitate costly corrections should they be incorporated in the finished product.

Most outstanding characteristics of welded design are the high efficiency of the joints and the rigidity of the welded structure. By properly distributing stiffening sections and fusing them to load carrying members of a structure, an extremely high degree of rigidity may be obtained.

Because of the rigidity of welded structures, welding design theory holds that the weld metal should have characteristics duplicating that of the parent metal as nearly as possible. The deposit should be equal to or slightly greater than the strength of the parent metal in tensile strength and elongation. It should not greatly exceed the tensile strength of the parent metal, particularly if it becomes more brittle (has less elongation) than the parent metal. A brittle weld stressed beyond its yield point may shatter and cause the structure to rupture and fail, whereas a weld of a slightly lower tensile strength but slightly greater elongation will yield a little and distribute the stress throughout the rest of the welds in the structure and thence to the load-carrying members of the unit without approaching a point of failure.

DESIGN APPROACH

To obtain the best results in a design, one should approach it with a flexible open mind that is keenly aware of the function which the product under consideration is to perform. Given this basic understanding, the designer should be resourceful and unrestrained in his earlier concepts of the form and operation of the product being designed. Consequently, he will not be limited by tradition or conventional means of making the product or accomplishing the functions. Such an approach requires, of course, that the designer have a broad knowledge of the characteristics of the various available fabricating means as well as the available materials and their relative costs in the locality in which the product is to be built.

Rarely in the design of any product is there a best method of fabrication specified or a best material specified. Usually the designer's major problem is to determine the best fabricating means and the best material. Should it develop in a particular job that the best means of fabrication is welding, the designer should not go overboard and incorporate welding in all spots. He should use it only where it is the most advantageous method. Even though a product may be basically of welded design, a superior product might result by combining welding with forgings and castings. For example, the product to be designed may be a machine which requires a number of bosses to provide adequate bearing for shafts. If these bosses are located close to one another and all in a limited area, it might be well to consider a casting of a material similar in characteristics to the base metal for this area. The multiple-boss casting could then be joined to the rest of the structure by welding. An application of this sort would be found to be less costly than individually welding the required bosses onto the machine. There are other instances where a forging might be advantageously employed to form some intricate part which otherwise would require multiple welds.

ORIGINALITY IN DESIGN

One of the greatest errors encountered in the design of a welded product is the fact that too many designers are prone to make the new design look like the object it is replacing – that is, the weldment is designed to look like a casting or a forging. Many designers feel flattered, in fact, if they are told that their welded design, after sandblasting, resembles a forging or casting. They shouldn't be. All too often the resemblance means that the designer has failed to take full advantage of the engineering freedom made possible by welding.

It must be remembered that welding makes possible various combinations of metals and alloys that can be used to gain the utmost economy and serviceability. Likewise, it should be remembered that there are many shapes and sizes of materials which can be used. The mere fact that the design is a welded design does not necessarily mean that all possible points should be welded if welding can be minimized by bending or pressing the parts.

It is most important, moreover, in welded design to provide easy access to all joints to be welded. As silly as it sounds, the shop is often asked to make a weld that cannot be reached or is inside a closed box, etc. Remember also, in approaching the design problem that the design

should be done in the engineering department rather than in the shop. This can only be done when the shop is provided with adequate engineering drawings, properly marked to indicate the location of welds and their sizes. It is only by proper engineering that overwelding can be avoided, and the maximum economy of welded construction attained.

If it is finally decided that the product is to be of welded design, it is quite important that the designer specify the types and kinds of welds that are to be employed. Designers not familiar with welding are all too often of the opinion that all welds are alike. Because of this misconception, they may hold that no weld will fail if properly made. On the other hand, the feeling may be that all welds are inherently weak and must be reinforced. There is also prevailing an unfounded belief that butt welds and fillet welds are similar in fatigue and fatigue load characteristics.

1. STRESSES GO UP with undercut as this photoelastic study indicates

2. OVERWELDING increases stresses as indicated by comparing two butt welds

WHICH WELDING PROCESS

If the design is to be welded, by what process? The answer to this question is one of major importance and should be given by the designer. This means that he should have some knowledge of all welding processes. He need not actually know how to weld by any of them, but he should be in a position to recognize the possibilities as well as the limitations for fabrication afforded by the different processes. Without such a knowledge of welding processes, he will not be able to take fullest advantage of welding in his design.

The process selected will naturally depend to large extent upon the welding equipment available in the shop that is to do the job. If arc, gas and resistance welding equipment are all available, however, it is up to the designer to pick the method that does the job best.

The availability of various methods of welding will not only be reflected in the design features but also in the overall cost of the finished product. If the proper equipment is not readily at hand, however, it will generally prove more satisfactory to do the job by the equipment the shop does have than to try to amortize an expensive welding machine against a job by using a less costly process.

In some instances, the type of service to which the finished design will be subjected will determine whether fabrication is to be done by arc welding, gas welding, spot welding, projection welding, stud welding or silver brazing. Having determined the process, the next big step for the designer is to determine the type of weld joint.

BUTT AND FILLET WELDS

When properly made, a butt weld and the parent metal adjacent to it may develop physical properties equal to or better than the parent metal. This type of weld will not fail. If failure occurs it will be in the parent metal and will travel across the weld just as though the joint did not exist. Such a weld will have a static load value of 100% and a fatigue load value of 100%.

In a fillet weld which has 100% penetration, the static load value will be found to be 100% also, but the fatigue load value has been reduced to a mere 40%. If fatigue loading should be encountered and if the right type of weld is to be used in the right place, care must be exercised in the design and selection of fillet welds.

The strength of a fillet welded joint and the static load that a weld will withstand may be calculated from the cross-section through the throat of the weld. Physical properties of the parent metal may be used since the deposited metal available is generally equal to or better than any weldable alloy. In comparing the physicals, it will generally be found that the ductility of the weld metal is always better than that of the parent metal. This, in reality, is one of the reasons why welds seldom fail. If the weld in question is not a 100% penetration weld, the reduction in static values is nearly in proportion to the reduction in cross-section of the metal through the throat section.

The four major factors to be considered in any design are cost, weight, durability and appearance. To these are to be added the minor considerations of design flexibility, greater strength and efficient use of material. While it is not necessary to consider all of these factors in the design of a product, usually one or more of them are found to be extremely important when the final design considerations are presented.

COST AS A FACTOR

In nearly every design, cost is the most important factor. In most instances, welded construction is the less costly. There are examples, however, where welding is a more costly means of fabricating than some other production method. This does not necessarily preclude the use of welding; when other factors are considered, welding may prove to be the most satisfactory means of fabrication. If the product in question is of a complicated nature but only a few are to be made, welding is generally more economical than castings because of the elimination of pattern and pattern change charges. The same is true of products where minor changes frequently occur.

Weldments usually can be machined less expensively than castings or forgings inasmuch as the rolled steel product is more homogeneous and presents less difficulties with hard spots, porosity and sand holes. Tolerances may be more closely maintained (thereby reducing cost) as there is usually less metal to be removed in the finishing operations.

The importance of placing the proper weld in the proper place in the design cannot be emphasized too greatly. Most failures of welding may be traced to poor design or improper shop practice. Generally most of them are traceable directly to poor design rather than inadequate design. The design of the weld joint not only involves the selection of the proper type of joint but also the determination of the proper amount of weld metal to be de-

posited. The designer should be careful in the calculation of his stresses so as to avoid overwelding. The deposit of metal increases with the square of the fillet size to make overwelding quite expensive. Underwelding, on the other hand, could lead to failure.

Having decided upon the type of weld, the designer is always confronted with the problem of the type of scarf to be used on the joint. On thin materials, the desired joint may be attained by merely flanging the sheets. Plate thicknesses will require beveling for vee and double-vee joints. If the thickness of the material increases still more, it may be desirable to go to a "J" type scarf. A "J" scarf requires less welding and may therefore be less costly. This type of scarf must be machined, however, and the danger is that the machining costs may outweigh the savings in weld metal. This point should be considered early in the design. Other points that must also be considered in connection with the use of a "J" scarf are the ease with which the plates may be machined, the necessity for good fit-up in the weldment and the type of weld involved. The use of the "J" scarf is extremely desirable where the weld is to be reinforced or back chipped.

CASTINGS AND FORGINGS

Castings and forgings, despite the thinking of some welding engineers, are used quite extensively in good welded design. They often present the least expensive way in accomplishing a particular task. This is particularly true where there is an abrupt change in section such as occurs in bearings bosses or where material for studs is necessary when the loading does not permit the use of fillet welds.

The extent to which castings or forgings are employed in a weldment is, of course, dependent upon the number of weldments involved. If only one weldment is to be made, it is sometimes too costly to substitute castings or forgings because of the costs of the necessary patterns or dies and the delivery delays involved. On the other hand, if fillet welds are not permitted or the structure is too complicated or too inaccessible for welding, it is smart to employ castings or forgings. Care must again be exercised to design the "replacement" casting or forging in such a manner as to change the section gradually. If possible, all welds made to join castings or forgings should be butt welds.

FORMED METAL PARTS

Many corner welds may be eliminated by the use of stamped, pressed or formed parts. The substitution of such items means a cutting down of the amount of welding involved. Use of formed metal parts, however, is dependent upon the availability of equipment to provide parts for processing in the designed product. If facilities are available, in the shop or, possibly, in the community, the possible savings in production costs should be weighed and considered in the design problem. The designer should bear in mind that plates up to 20 feet in length and an inch thick may be formed by bending. Even thicker plates of shorter length may also be formed in this manner.

In any bending operation, the radius of curvature should be as large as possible. The higher the carbon or alloy content of a material, the larger the radius required. For mild steel plates up to ½ in. in thickness, a ½ in. radius is usually the minimum to be employed. For plates up to 2 in. thick, the radius should be 1½ times the plate thickness; for plates above 2 in. two to three times the plate thickness.

SELECTION OF MATERIALS

The designer who is designing a product for welded fabrication may be extremely flexible in his choice of materials. Practically any metal, ferrous or non-ferrous, may be welded providing the proper technique and the proper welding process is employed. This does not mean that all materials are weldable by any welding process and technique; it must be the proper process or technique. The proper technique involves not only the selection of the proper filler material for the job at hand but may also necessitate adequate jigging, preheating, postheating and other operations necessary to complete a successful weld.

If the design demands it, dissimilar metals may be welded. In such applications, however, care should be exercised to avoid difficulties that might arise from the differences in the coefficient of expansion of these metals or from electrolytic corrosion or other conditions that might develop when dissimilar metals are joined to one another.

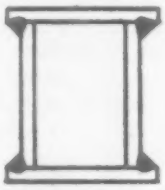
While it is not uncommon to employ stainless steel, aluminum, bronze, brass or copper in the design of a product, the most common material is a low-carbon steel conforming with SAE 1010 or 1020 specifications. This material is readily available, and adequate filler materials have been developed for use with it. The same is true of the low-alloy, high-strength steels up to 0.25% carbon.

Steels having above 0.35% carbon generally require a special technique to insure a satisfactory weld. Sometimes it is felt that it is necessary to go above 0.35% carbon to obtain special characteristics such as higher hardness or greater tensile strength. In these instances the designer should investigate the possibilities of obtaining the desired characteristics by using manganese or molybdenum alloy steels instead of plain-carbon steels having a higher carbon content. These two alloys have little or no effect on the weldability and may produce a much more satisfactory product.

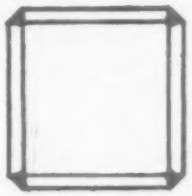
LIGHTER AND STRONGER

If weight is a consideration when a product is designed, the engineer is forced immediately to welded construction. Welding not only affords the best means of reducing weight, but it does so without affecting strength or rigidity. Should the designer wish to build the strongest and lightest possible product, he should combine welding with low-alloy, high-strength steels or stainless steels because these two materials afford the best weight-saving possibilities. Welded construction enables the designer to use the sections required regardless of how thin they may be. He is not restricted by the ever present "thinnest section" that can be cast and is thus given a further opportunity of saving weight.

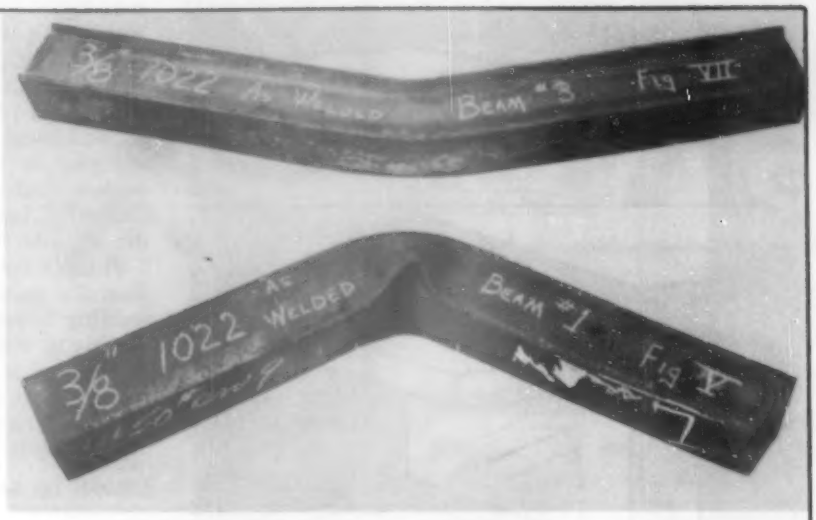
Let's look more closely at this way of reducing the weight in product design by turning to welding. The easiest manner in which weight may be reduced is by replacing a lower quality steel with a higher quality steel. For example, mild steel might be replaced by low-alloy, high-tensile steel. When such changes are made the design must be checked carefully to be sure that proper balance is maintained by adequate distribu-



3. LOAD ON WELDS in this built-up beam



4. PLATES TAKE LOAD in this beam design



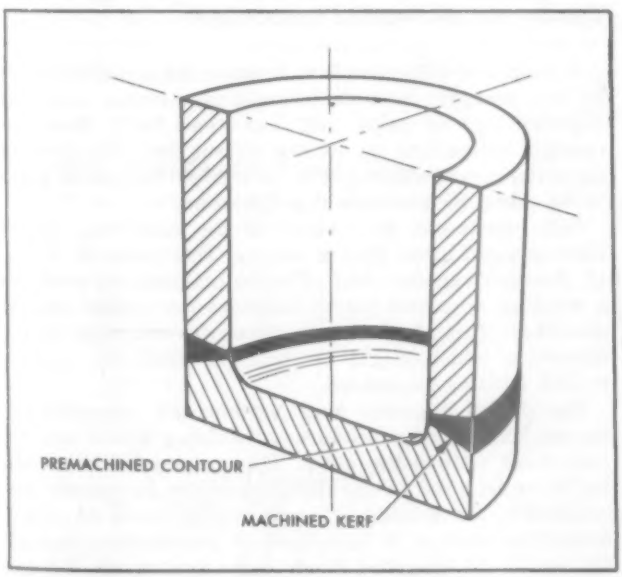
5. FAILURE for beam (Fig. 3) means only bending for beam of Fig. 4 design under same loading

tion of materials. This care will insure a smooth flow of stresses.

Should the design recommend higher unit stress or a lower factor of safety, the designer must know what he is doing. Extreme caution must be exercised in his calculations to insure that adequate material is being used.

In the switch to higher strength alloys, it is sometimes necessary to reinforce the lighter sections with ribs or gussets near lightening holes. Lightening holes may serve a double purpose inasmuch as they may lighten the section and also provide access holes to make the design possible or workable. Such lightening holes must be on the natural axis or in the center of large panels. Lightening or access holes must not have square or sharp corners which might serve as stress raisers under operating conditions.

6. WELDS IN TENSION are stronger than those in shear on this cylinder cap



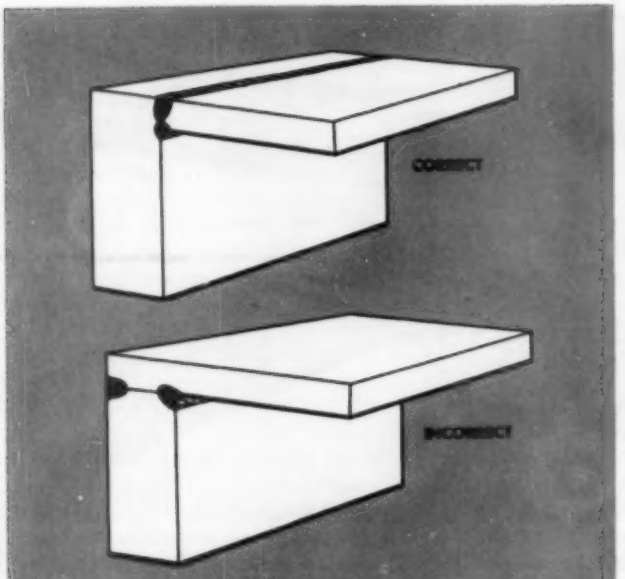
STRESSES AND WELDED STRUCTURES

The transmission of stresses throughout a welded structure is of considerable importance. The way in which loads are transmitted through welded joints is of prime importance. Figs. 1 and 2 illustrate the effectiveness of the polarized-light method of examination for engineering stresses of two butt joints. It is evident that the so-called reinforcement butt instead is a detrimental stress-concentrating element. Note that the stress flow is more uniform in the one with the least "reinforcement," and the stress concentrations are not so acute as in the one with the greater reinforcement. For this reason, butt welds should be made as near flush with the top of the plate as possible. However, no groove should be allowed to exist at the juncture of the weld metal and the plate since this would be even a more violent concentrator of stresses, as is illustrated in Fig. 1.

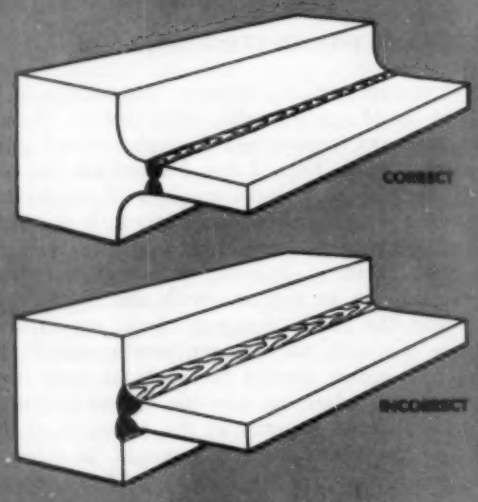
RELATION OF WELDS TO JOINT MEMBER

Seldom is it necessary for the weld metal in a joint to be placed in a position where it carries the full load in a structure. The only exception is a butt weld in which the cross-section of weld metal is in direct line with the plane of the plate and of the same thickness. In most designs, it is possible to place the weld in such positions as to hold the parts together but to make the load transfer from one member to the other without throwing the full load on the welded joint.

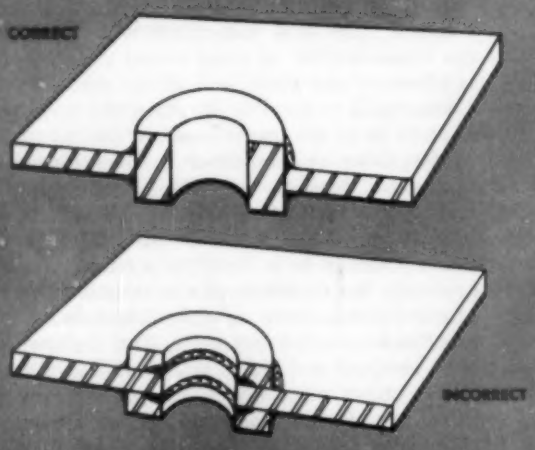
Fig. 3 diagrammatically illustrates placement of the weld metal in a position to take the majority of the load when subjected to a bending moment. In Fig. 4, on the contrary, the members of the structure carry the load, while the welds serve as wedgelike joining devices and not as load-carrying elements. Fig. 5 shows actual tests of box sections welded as shown in Fig. 3 and Fig. 4 and tested under very heavy impact bending loads. The type of construction shown in Fig. 3 (lower view, Fig. 5) failed by rupturing through the weld, whereas Fig. 4 bent sufficiently but did not rupture the weld (Upper, Fig. 5). The same principle applied to capping of a cylindrical member is illustrated in Fig. 6; in this



7. WELD LIGHTEST PLATE when possible



8. REINFORCED FILLETS are expensive. Avoid them when practical to do so



9. INSERTED BOSS requires less welding and machining

case the weld is in compression or tension rather than acting as a wedge or being placed in shear.

The principle of the use of weld metal as a key or wedgelike joining member instead of a total stress carrier is important in all welded joints. Such design provides an additional factor of safety to take care of possible operator or manufacturing imperfections such as imperfect steel or irregular electrodes, which may be encountered because of conditions beyond the control of the manufacturer.

Filler materials which have a lower yield strength than the parent metal, are often used, especially when welding low-tensile steels or certain alloy steels. It is especially important in such cases that the metal be distributed to hold the joint together but not to take the full load, even though the welds may be greater in size than the section of the parent plate.

DESIGN TO SAVE WELD METAL

Since weld metal itself is expensive material, any design which can develop the strength of weld metal to the best advantage and reduce the quantity used is an important consideration.

Fig. 7 shows examples of the use of weld metal; both efficient and the least expensive on one hand and the incorrect design on the other. The question as to whether the method shown in Fig. 8 is desirable depends upon the cost of producing the contoured member to which the plate is welded. The machining costs of producing such a piece may be more expensive than the extra welding. There is some question as to whether any saving would be gained in the overall cost of this design.

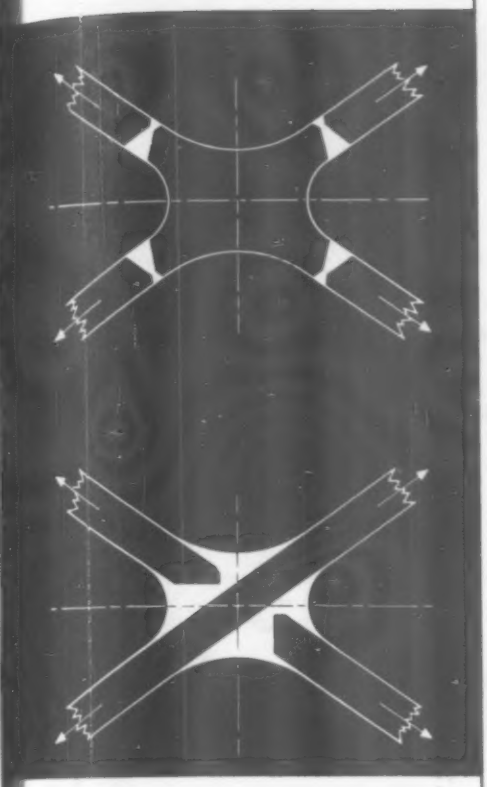
For mass production of welded structures, the resourceful use of forged or special rolled sections as shown in Fig. 9 may provide a real saving in weld metal as well as a superior design from the standpoint of strength and weight. Fig. 10 shows a wider variety of shapes, which may be forged or even rolled on a commercial basis, together with some suggested uses for such special sections. It should be noted that there is a trend of thinking in the steel industry which before too long will call for special shapes for welding. The result may well be a line of special shapes, probably of a tubular nature, which will be as well suited to welding as the present structural shapes are to riveting.

DISTORTION OF WELDED STRUCTURES

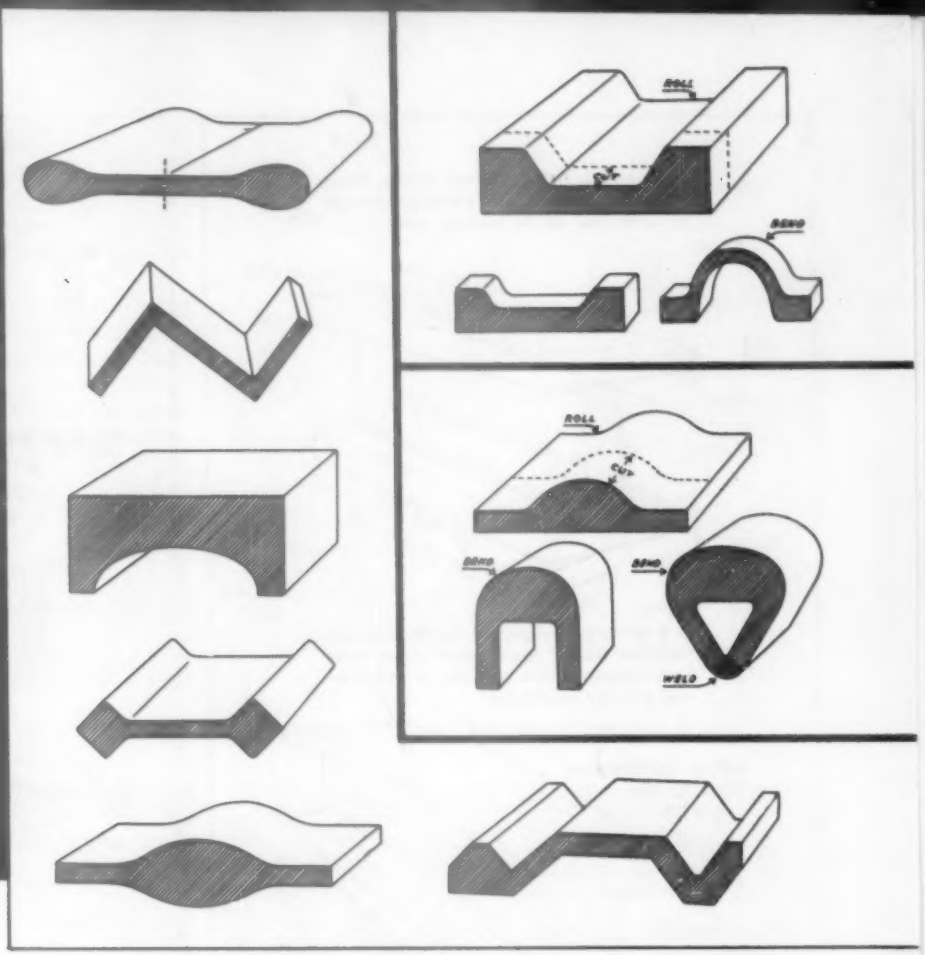
A degree of distortion is to be expected and anticipated by the designer because of welding stresses. After an experimental or pilot unit has been built, however, enough indications as to the extent and direction of distortion from welding will be evident to enable steps to be taken to minimize the distortion.

Often parts can be prebent so the distortion "pulls" them straight in the final structure. This is shown in Fig. 11. Another common and effective means is to establish a welding sequence which balances one stress against the other. This planned procedure prevents most of the distortion which might be brought about by uncontrolled welding sequences.

The design engineer must assume the responsibility for recommending procedures of welding which balance one stress against the other. This responsibility should be borne in mind in the design process. Automatic arc welding by the submerged-melt method tends to reduce distortion because of the depth of penetration through the joints and the speed at which the arc travels. If auto-



10. INTERSECTING WELDS are made with (upper) or without (lower) transition piece



11. SPECIAL SHAPES designed for welded fabrication

matic welding equipment is available and the structure is one that can be designed for it, the design engineer may find here an important means of preventing distortion.

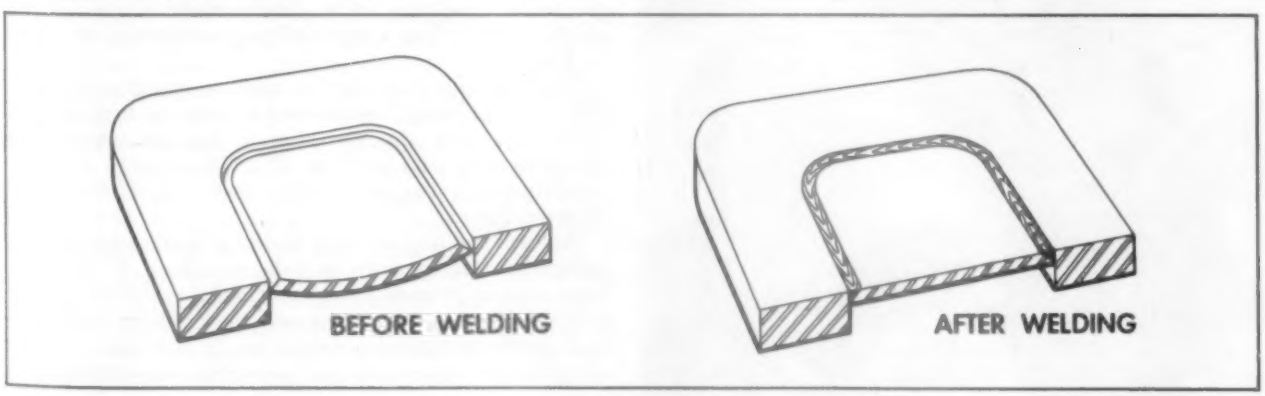
If the structure is designed with the majority of the welding concentrated on one side, or in such a way as to cause the parts to draw, distortion can be prevented by prebending of the main parts on which the welding is to be done. Such bending may be accomplished by clamping the parts in a fixture when they are assembled for welding or separately prior to setting up. (Fig. 12)

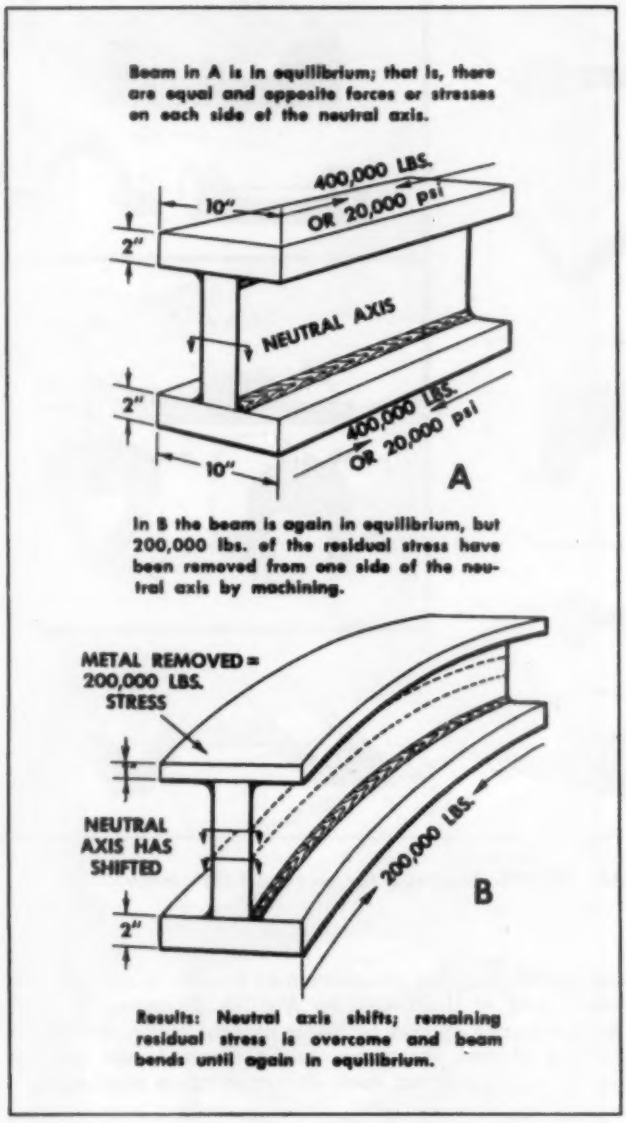
Many welded structures will be machined. Where the removal of metal will cause a shift in the balance of metal section with relation to the residual stresses set up by welding, the structure may become distorted after machining as illustrated by Fig. 13. Planning to avoid such warping should be given careful study. Stress relieving of such structures would eliminate the residual stresses and prevent such distortion upon machining.

WELDING TO SAVE TIME

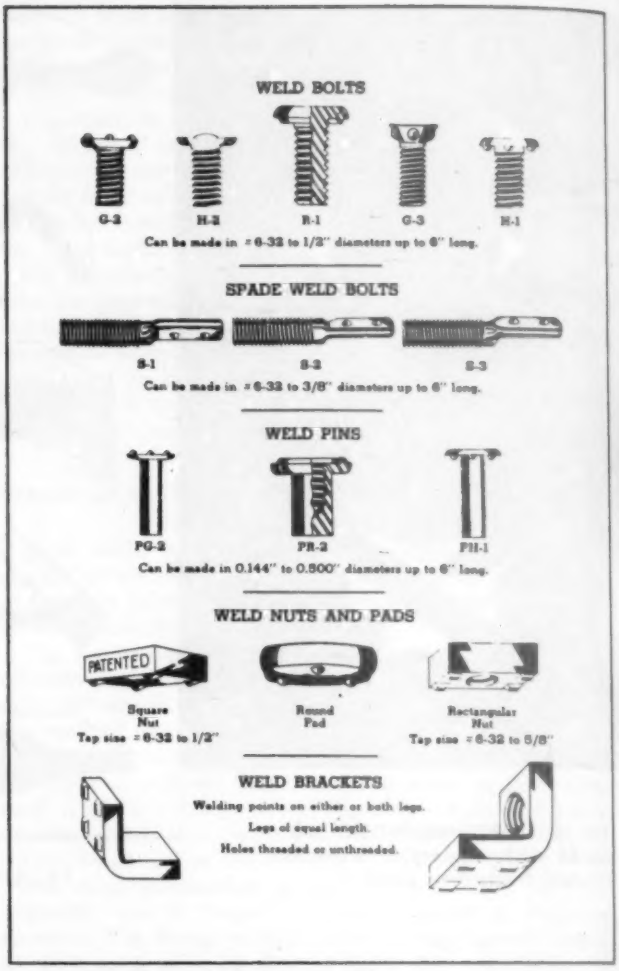
There is no limit to the possible uses of welding in the design field. If the product is not a welded design, welding still may be used to reduce production costs and speed up production. The kind of welding employed may depend on the quantity to be produced and the quality of the work desired. For example, take the re-

12. DISHED CLOSURE PLATES can shrink



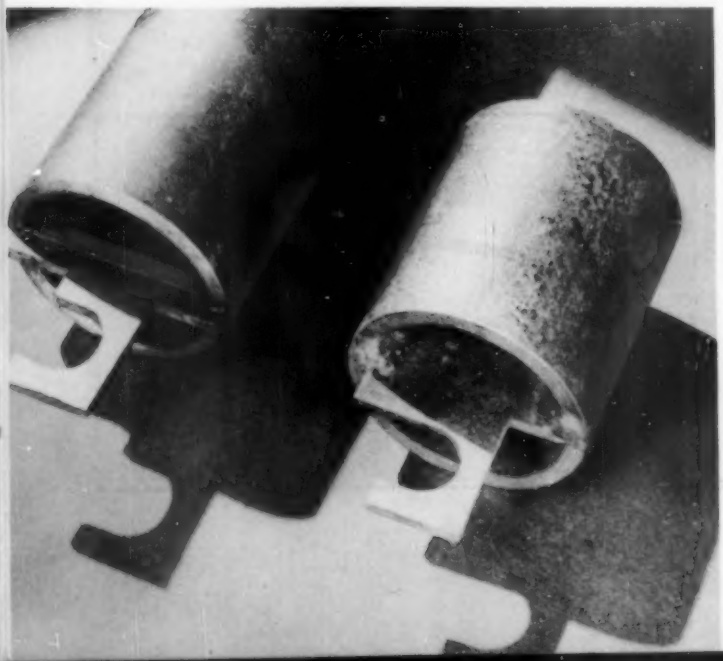

Beam in A is in equilibrium; that is, there are equal and opposite forces or stresses on each side of the neutral axis.
400,000 LBS.
OR 20,000 psi
10"
2"
NEUTRAL AXIS
2"
400,000 LBS.
OR 20,000 psi
10"
A
In B the beam is again in equilibrium, but 200,000 lbs. of the residual stress have been removed from one side of the neutral axis by machining.
METAL REMOVED = 200,000 LBS. STRESS
NEUTRAL AXIS HAS SHIFTED
2"
200,000 LBS.
B
Results: Neutral axis shifts; remaining residual stress is overcome and beam bends until again in equilibrium.

13. RESIDUAL STRESSES cause warpage



15. FITTINGS for projection welding to machine elements

14. MOUNTING HOOKS of spot welded (left) and arc welded design (right)

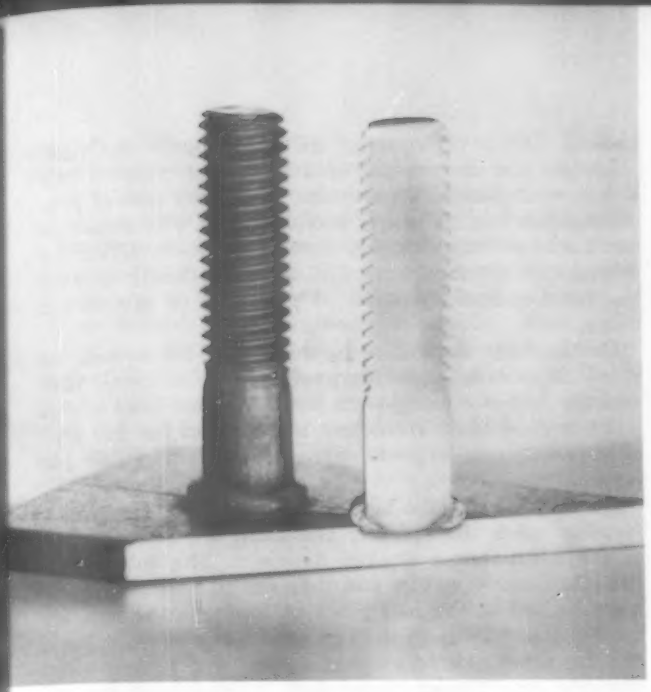


sistor mounting hooks in Fig. 14. The left-hand hook is spot welded at an approximate saving of 40% over the arc-welded hook pictured on the right. This saving was made possible because of the quantity. Spot welding also produced hooks of better appearance and eliminated post-weld cleaning.

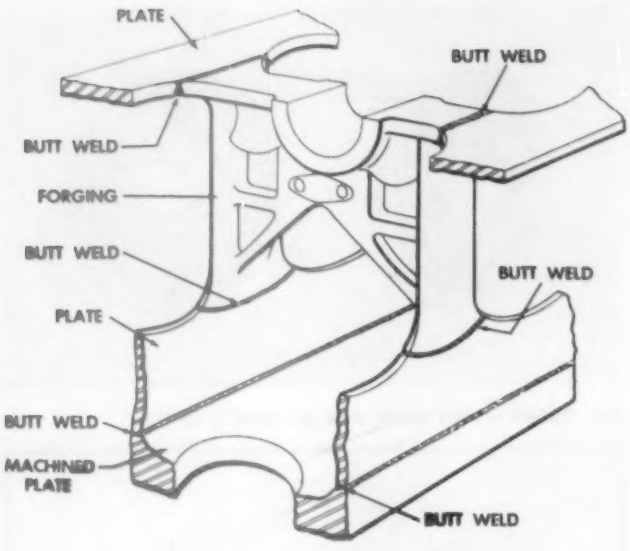
When designing for resistance welding, it is important to select the proper materials. Certain shapes such as round, formed or structural pieces may be used with little or no preparation. It is often possible to put projections on screw machine parts with little or no additional cost. These projection-welding applications are definitely time savers where they can be used advantageously. For the designer who does not care to design all screw machine parts, ready-made parts for any projection-welding application are available, as shown in Fig. 15.

Stud welding may also be used to speed up production. It is generally considered a modified form of projection welding, though there is also an arc-welding adaptation of stud welding. Fig. 16 pictures two arc-welding studs, one sectioned to show clearly the extent of weld fusion.

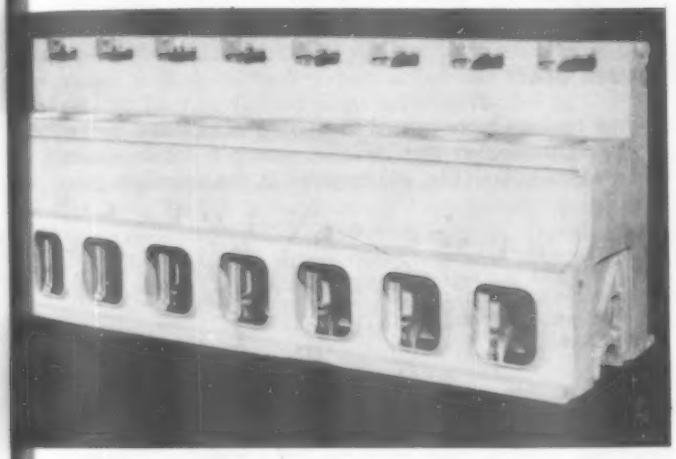
The arc method of stud welding was originally developed to fasten studs to solid members. It has since been used to provide a very successful means of quickly and firmly attaching fasteners, hooks, lugs and other such parts on machine structures. It is widely used by the resourceful designer and provides a very satisfactory



16. ARC WELDED studs. Note complete fusion



17. FORGINGS should be butt welded in place



18. RIGIDITY UP, weight down on this 800 hp Diesel engine frame. Forgings, castings, plates and welding are combined

19. SPANNER WRENCHES — 3 stamped (left) and 3 welded (right)

means of fastening a stud to a plate without threading the lower end or without drilling and tapping the lower member.

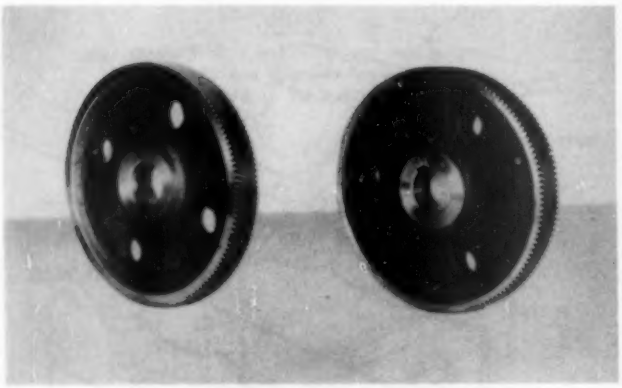
Use of forgings and castings in weldments is recommended for those sections which cannot be successfully produced by other means. Examples are where a gradual change in cross-section is desired or where a fillet weld would not be particularly desirable. In the Diesel engine frame cross-section, Fig. 17, the use of a forging as the main bearing support member makes possible a smooth, uniform change of section from the main bearings and cap studs to the side tension members. Because of the severe loading, butt welds are employed between the forging and side plates and the forging and side rails.

In this illustration, note how the designer has kept in mind the accessibility of the welds to the weldor. It would be quite easy to design a piece that would not be accessible for welding, but would be impractical and wasteful of time and possibly material. The finished 800-hp Diesel engine frame is shown in Fig. 18. In addition to the use of forging, the main strength members of this frame are carbon-molybdenum steel plates. Weight is down and the rigidity is up, due to welded design.

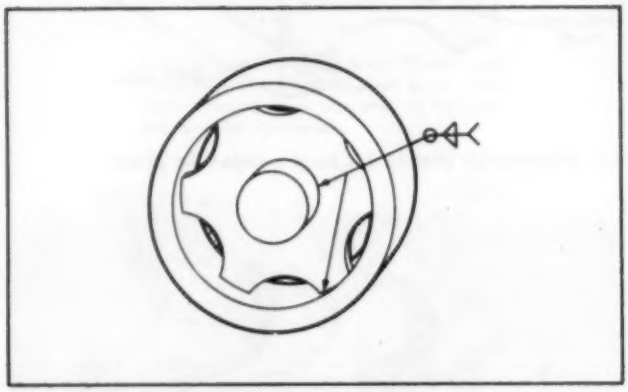
SIMPLIFIED DESIGN

Proverbially, there is more than one way to skin a cat, and there is also more than one way to use welding in product design or redesign. In some instances the importance of welding is overlooked because its use is not too obvious. An example is found in Fig. 19, which pictures three spanner wrenches of stamped design and three welded counterparts.

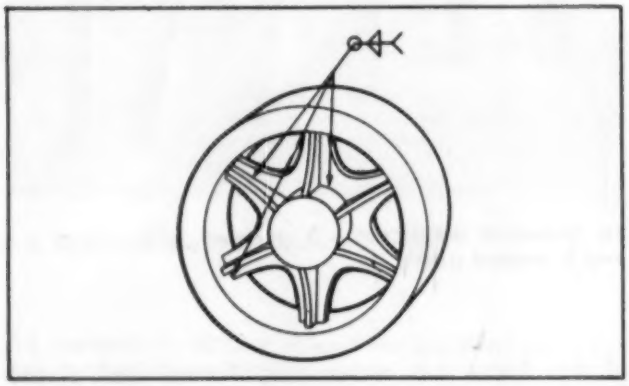
The manufacturer of collet chucks had provided spanner wrenches as a part of the chuck kit. The cost of a die to punch wrenches for the smallest size chuck was approximately $150. Since this cost was distributed over a considerable number of wrenches, it could easily be written off without making the cost per wrench excessive. However, the wrenches thus produced, being stamped from light strip stock, were weak and easily



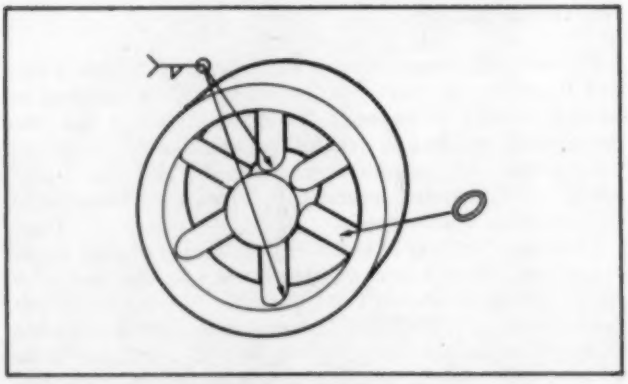
20. GEARS — cast (left) and welded (right)



21. FLAME CUT rim, web and hub for this gear blank



22. ROLLED RIM, flame cut web, stiffeners and hub



23. FLATTENED PIPE spokes with flame cut rim and hub

broken. This, of course, did not appeal to users.

Larger size chucks and special chucks required only a few wrenches of a particular type. The cost of producing dies became nearly prohibitive so wrenches were hand made—an extremely costly operation. Often the appearance of the wrench was not too satisfactory, since the hand operations consisted primarily of sawing and filing.

On the largest size chucks, the cost of the wrench die was $750, material costs per wrench—approximately $2.00 and the cost of making each wrench about $1.00 on this basis, a total of 20 wrenches, a large run for this type of wrench, cost approximately $810.00 or $40.50 per wrench.

Redesign led to the adoption of welding. The manufacturer made the spanner end from a piece of tubing of the approximate desired diameter. The tubing was cut into narrow widths and then cut in half. Two holes were drilled in the half piece of tubing — one hole for the hardened piece of drill rod used as the wrench pin and the other hole to provide a location for the handle. The pin and handle were then welded in place. An attractive wrench without costly dies or hard-to-get material was produced at $1.75 each. On an order of 20, resulting savings were $772.50 over previous manufacturing methods.

WELDED GEARS

Gear makers have turned to welded design as a means of saving money. A comparative example between cast and welded gears (Fig. 20) is given in the accompanying table:

WEIGHTS	CAST	WELDED
Rough weight	267 lb.	233 lb.
Finished weight	232 lb.	156 lb.
Finished weight saving	—	76%
Weight saving	—	32.7%
COSTS		
Material	$42.35	$19.40
Labor	31.54	39.48
Total cost	73.89	58.88
Cost saving	—	15.01%
Saving	—	20.3%

Additional saving due to elimination of lapping (per reduction gear assembly amounted to $12.

The weight savings and subsequent reduction in cost made possible by the design of welded gear blanks may vary from these figures according to design. Alternatives vary from the gear pictured in Fig. 20 to those sketched in Figs. 21, 22 and 23. In connection with a gear design problem cost studies should be made to determine the manner adopted to form the rim. If the scrap may be utilized, it may prove less expensive to flame-cut the rim from a steel slab than to roll it from bar stock.

Referring again to Fig. 20, the welding in this application not only reduces cost but avoids many of the difficulties encountered in the production of cast steel gears.

Cast gears are usually centrifugally cast. The gear must be rough machined before heat treating to make sure that the heat treatment penetrates uniformly to the prescribed depth. During the initial machining operation, sand or blow holes are often uncovered, and such defects must be chipped out and rewelded before heat treating with a high-carbon-steel rod. Most manufacturers reject or scrap any gear with welding repairs that extend over two or more adjacent teeth, over 10% of

the face width on the outside rim or over 15% of the face width in the internal section.

Additional casting defects are sometimes discovered during the hobbing process or finish machining. Defects at this stage of production may result in the damaging of costly cutting or hobbing tools, and sometimes make it necessary to scrap a nearly finished gear.

Since welded gears are made from rolled steel, uniformity of material and freedom from defects is usually assured. These factors permit the maintaining of fixed time for tool operations and result in lower tool repairs on all machines. Scrap loss is unknown unless the operator makes a mistake. Tests show that the finished welded gears are less noisy than cast gears, though some machine designers have a feeling that disc gears tend to promote drumming.

A WELDED EQUALIZER

Opportunity to compare a box section with an I-beam section is afforded by the design of a welded equalizer (Fig. 24) for an oil-well pumping unit. This equalizer serves to equally distribute the walking beam load of the pumping unit on the two pitmans of the drive unit. Such service subjects the equalizer to bending as well as twisting stresses. In tests to destruction, the cast equalizer with the I-beam, despite the fact that it had greater deflection, took a permanent set under a load of 90,000 lb. The welded equalizer was loaded to 120,000 lb before it buckled.

These findings demonstrate that the manufacturer was justified in replacing steel castings with weldments. They also show that it is feasible with weldments to change the cross-section of a part, not only to increase its strength but to cut down deflection and save weight, even though the base metal used might have lower physicals than that used in the original part.

GENERATOR FRAMES

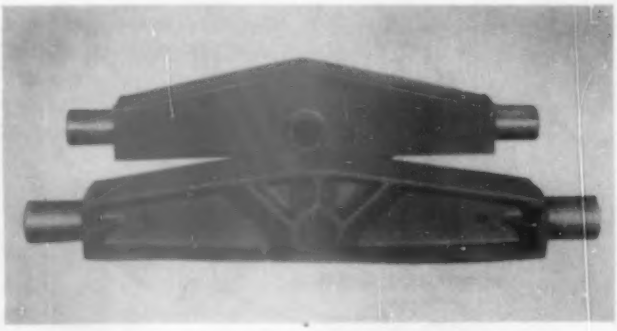
Cost and weight are important factors in the highly competitive market for portable light plants when a manufacturer in this group decides to redesign his engine generator sets, the resulting cost and weight are watched with keen eyes.

In the operation of small or medium generators, the changes in electrical load are often very great. This may be the result of starting motors across the line, or it may be the general characteristic to the load. In any event, the service is more severe than that imposed on large generating units in which the load changes are relatively small.

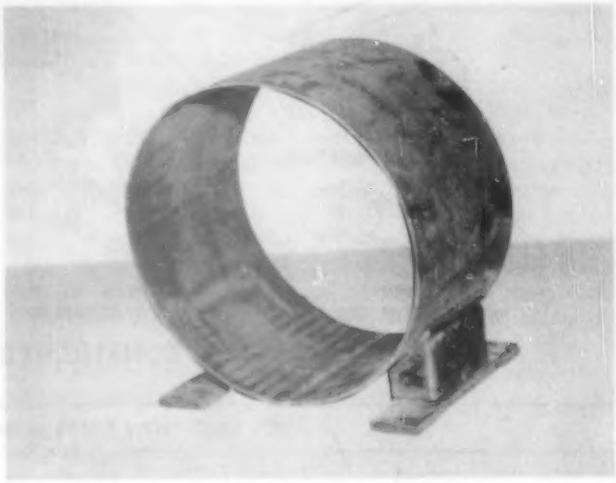
Resultant vibration of the engine-generator set caused by load variation, is an important factor to be considered in the design of a generator frame.

As a characteristic of these units, the stator assembly is housed in a cast-iron frame which consists of a heavy rigid cast shell having ribs inside to receive the stator laminations. Its heavy rigid widespread feet are cast integrally, Fig. 25.

The manufacturer concerned decided to substitute a welded steel frame for the cast member. To reduce weight and cost further, the designer deemed it desirable to eliminate the ribs from the inside shell. This, of course, was a radical departure from the accepted practice of ventilating large generators. On the other hand were the savings that could be effected in material costs and the savings in labor which would result from eliminating the welding and machining of ribs in the



24. EQUALIZERS — welded box type (upper) cast I-beam type (lower)

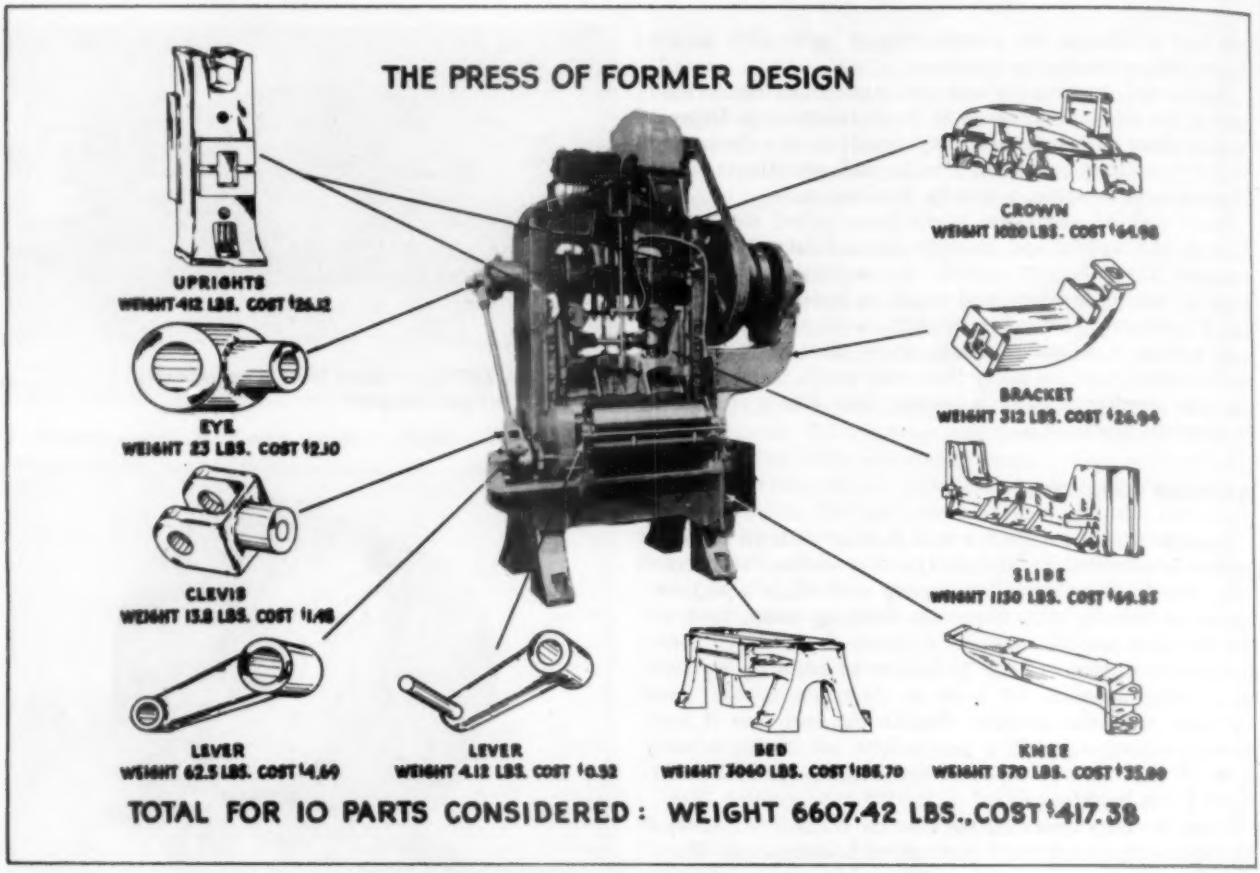


25. CAST IRON generator frame

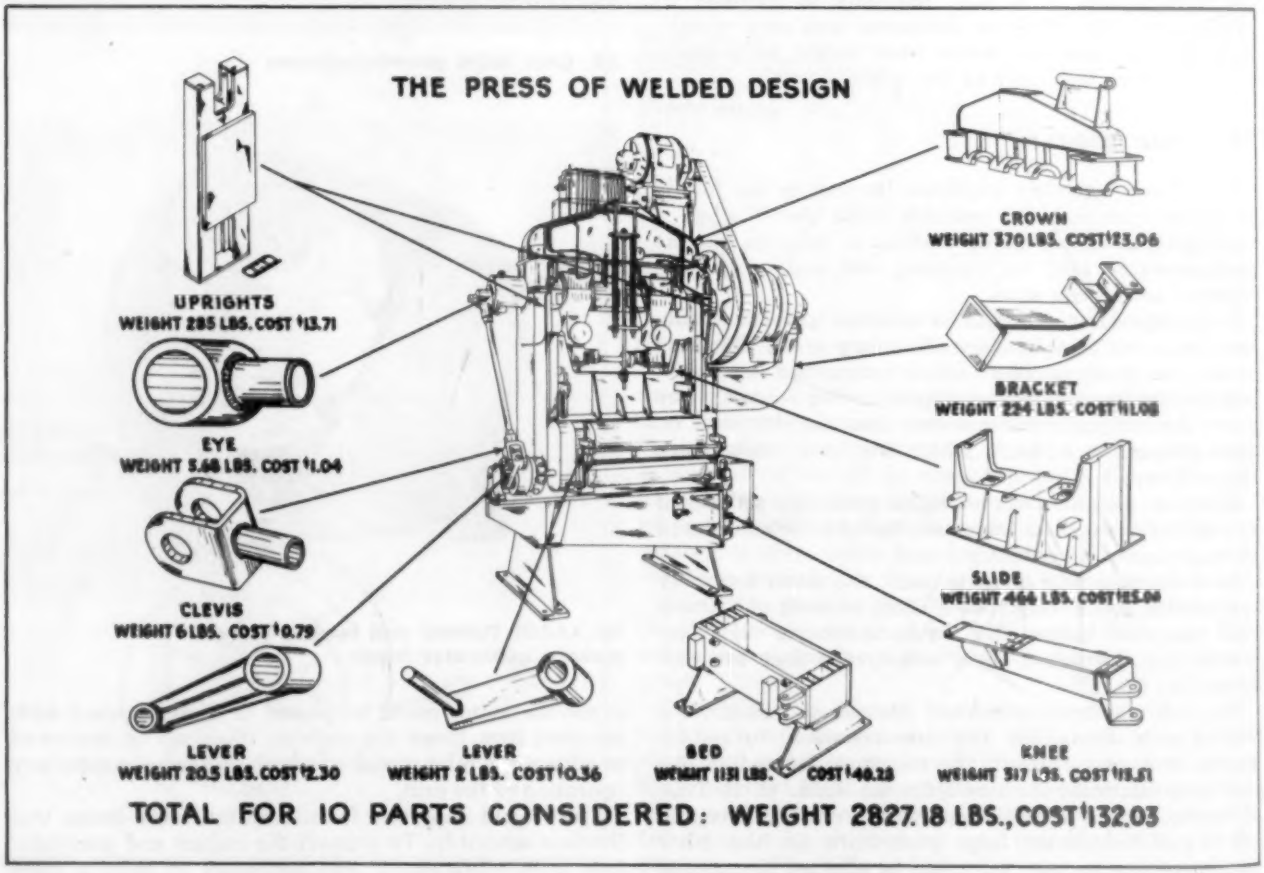
26. LARGE TUBING and formed plates make a generator frame

event the stator could be placed in direct contact with the steel core. Since the question could not be answered in advance, a pilot model was built to assure satisfactory operation of the unit.

The second important feature of the frame design was the foot assembly. To support the engine and generator free from vibration, it was necessary to have a rigid widespread foot. The engine-generator set is sometimes operated in dirty surroundings, so the foot design should



27. CAST IRON PRESS is heavy and awkward looking



28. MORE IS REQUIRED than the mere substitution of welding for castings

be such as to eliminate pockets and irregular shapes which might serve as dust catchers. It was also essential that the generator present a pleasing appearance and be so designed that it could be kept clean fairly easily. Steel with its smoother surface has a definite advantage over cast iron in this respect. Another advantage in the favor of steel is its freedom from foot breakage, either in manufacturing or shipping. Unfortunately such breakage sometimes occurs with cast-iron feet.

The steel frame developed through this design study is pictured in Fig. 26. By using welding instead of the previous cast construction, the overall weight of the unit was reduced by 16%. There was a 36% saving in the total weight of the frame itself, but some of the weight saving through welding was lost by the redesign of other components of the generator. The cost saving per frame assembly was 25%. The saving in transportation charges is not reflected in the above figures, but it is important. The gross shipping weight of the engine-generator unit, crated for domestic shipment, is approximately 15% more than its net weight. Hence a saving in shipping costs based on a weight saving of some 50 lb should be considered.

MACHINE TOOLS

Machine tool makers are looking more and more to welding design. Experience has shown that welded fabrication offers many advantages. Through its use, tooling costs are kept at a minimum. Likewise, welding is found suitable for quantity production, and often the manufacturing of machines is made easier. Welding also makes it easier to keep the exterior of the machine smoother in appearance.

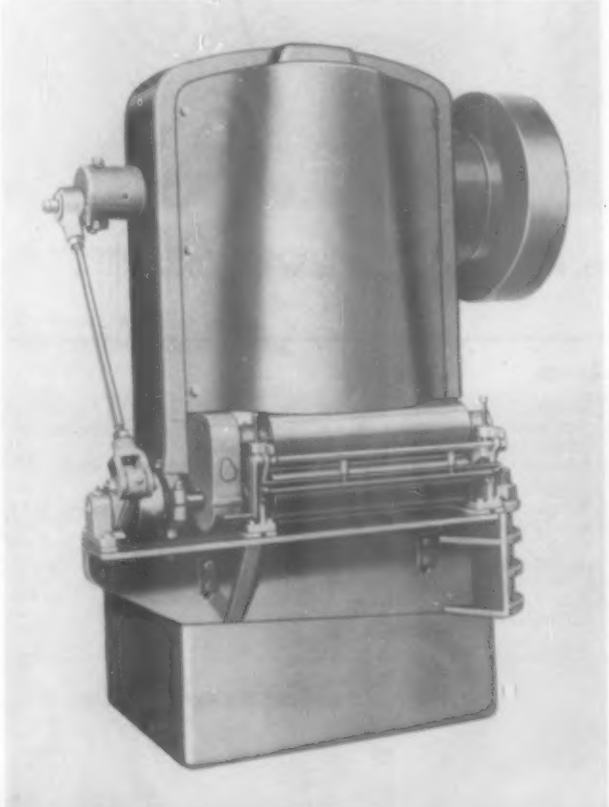
Too often in machine tool design, the designer limits his activities to changing a cast-iron part to a welded part for the same general appearance. Fig. 27 pictures a complete metal working press that, essentially, is made up of a number of parts such as the base, crown, frame, brackets, levers, etc. Some of these component parts and their relative locations on the press, together with weight and cost data, are also shown in Fig. 27.

By redesigning the press for welding it was possible to effect a considerable saving in both weight and cost (Fig. 28). In the redesign, however, the designer changed only the style of manufacture. As can readily be seen, the fabricated parts are quite similar to the cast-iron parts. Such a design practice represents a wasteful use of material. Cast-iron parts require heavy flanges to join them to other parts, but such flanges are not necessary in welded construction.

A designer cannot hope to duplicate a cast-iron design in welded steel and gain the advantages of lighter weight, greater strength, greater durability and more pleasing appearance at lower cost. All of these qualities may be attained, however, if the designer exercises sufficient originality in his design. Nor need any functional use of the machine be sacrificed.

Fig. 29 pictures the manner in which the press (Fig. 27) should appear when fabricated by welding. It now has a modern streamlined appearance because many of the parts have been relocated. A structural box base has replaced the old cast-iron press bed. The motor has been removed from the top of the press and put behind the flywheel on a bracket. A cover plate has been put over the front of the machine for appearance and safety reasons. By utilizing the appearance factors made possible by welding, the designer has been able to design a machine of greater style and beauty. Yet the redesign press serves all the functions which its cast-iron counterpart was designed to handle.

29. SAFER and more attractive press by welded design



VERTICAL LATHE

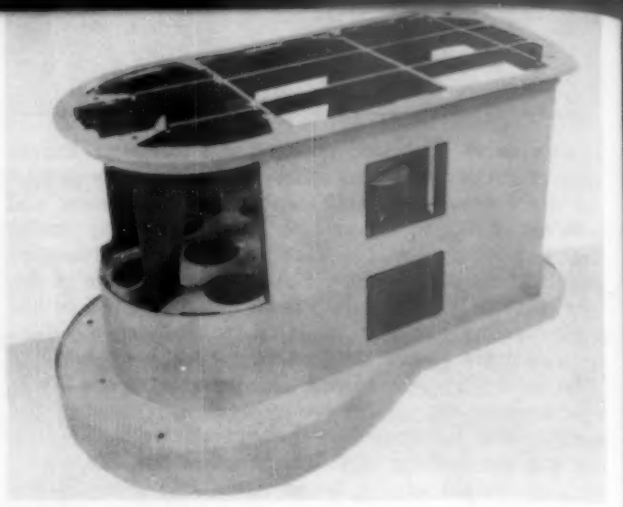
A machine tool manufacturer turned to welded design because it seemed to offer outstanding advantages in the developing of a single-purpose machine tool. Development costs were greatly reduced by the absence of patterns. Then, too, changes in design could be readily made since it was not necessary to alter the pattern for modified castings. Another important factor was that the absence of patterns eliminated the necessity of pattern storage space. Flat steel plates which could be easily stored and handled until the machine began to take shape were all that was required.

On this lathe, the designer endeavored to keep the number of visible welds to a minimum. A design of this nature would naturally keep the amount of welds also to a minimum. Care was exercised in the placement of the welds to keep distortion down and at the same time to eliminate highly stressed welds. The parts were designed so they would go together easily and accurately in welding jigs without fitting or unnecessary corrections.

As may be seen from Fig. 30, the weight of the casing of this vertical lathe was reduced through the use of extensive lightening holes. Also, the ribs and plates which were not to have continuous welds were flame-cut with scalloped edges, Fig. 31. This design thought of scalloped edges made it easier to carry out any subsequent sizing which might prove to be necessary. It also provided an accurate guide to enable the welder to space the welds correctly.

In a design of this type, it should be noted that tight limits on the length of the ribs are avoided wherever possible by keeping down the number of butting edges. Ribs must not be longer than the depth of the side plates. If they are shorter, any pull that takes place when welding them to the base is of little consequence because of

the presence of a reasonable gap. Careful thought in this design resulted in a vertical lathe Fig. 32, that is quite rigid, yet shows little indication as to location of its many welds.



30. LIGHTENING and access holes insure good welds

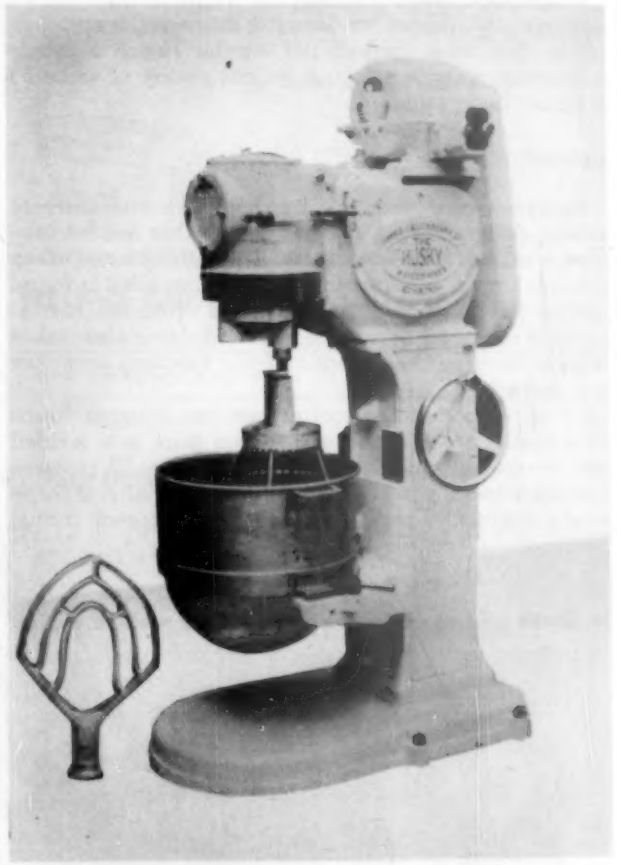
IN THE FOOD FIELD

Before the war a manufacturer in the food mixer field was producing the 80-quart bowl capacity mixer shown in Fig. 33, for use in the bakery and food processing industries. This mixer was composed of a cast-iron column with a vertical sliding mixing bowl saddle. On the head of the column was mounted an integrally cast four-speed gear box with a bevel reduction gear. The motor, mounted above the gear box, drove the input gear shaft through a gear and chain drive arrangement. With the coming of the war the manufacture of this mixer was discontinued.

After the war, manufacture was renewed on a modernized mixer. Though vastly improved in appearance (Fig. 34), the new mixer was still of cast-iron construction. It weighed 1,782 lb – 336 lb more than the prewar model. Increased material costs and extremely difficult foundry conditions greatly restricted the output, so it was decided to redesign the mixer for arc-welded construction.

The redesigned model is shown in Fig. 35. A considerable saving was achieved in both weight and production costs through the redesign for welded construction. The welded mixer weighed only 600 lb and was, of course, less costly from a material standpoint. Since it was fabricated from rolled steel instead of cast-iron, breakage in shipment was practically eliminated. The cost of manufacture was reduced, finishing costs alone dropping by 75% because of reduced weight, freight costs were reduced by 40%. The sales price reflected all of these savings, being reduced by 30%.

The light weight and compact dimensions of the redesigned mixer resulted in easier installations in the bakeries. With its smooth surface, the users found that the mixer was much easier to clean in daily use. All of these features, so helpful to the customer, were the result of a designer making the best possible use of welding.



33. PREWAR CAST IRON 80-qt food mixer

WELDING FOR FUNCTIONAL USE

Fig. 36 pictures four road rollers of conventional design, and Fig. 37 shows the manner in which this type of roller was redesigned for better functional use. Because of its high body, the redesigned roller may operate close to high obstruction and at the same time is capable of operating in close quarters. It presents an excellent example of welding for a functional purpose.

The redesigned roller cost approximately the same as the previous cast-iron, structural frame work roller.

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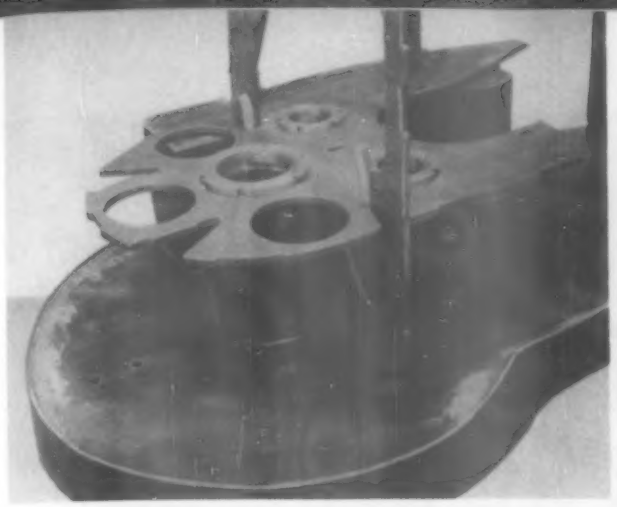
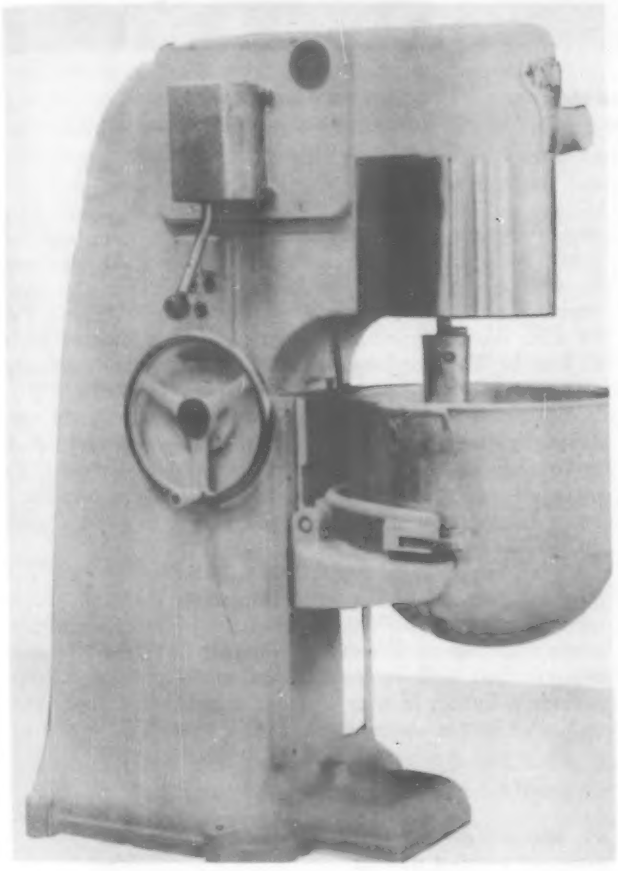
Illustration credits: Figs. 1 and 2 Lincoln Electric Co.; Figs. 3, 4 and 5, R. L. LeTourneau, Inc.; Figs. 6, 10 and 11, Lukenweld, Inc.; Figs. 7, 8, 9, 12 and 13 United Welding Co.; Fig. 14, Westinghouse Electric Corp.; Fig. 15, Ohio Bolt and Nut Co.; Fig. 16, Nelson Stud Welding Div., Morton Gregory Corp.; Fig. 17, United Welding Co.; Fig. 18, Lukens Steel Co.; Figs. 19, 20, 24 to 42 inc., James F. Lincoln Arc Welding Foundation; Figs. 21, 22 and 23, Hobart Bros. Co.



31. SCALLOPED EDGES aid in locating welds

32. FEW WELDS are visible on this vertical lathe

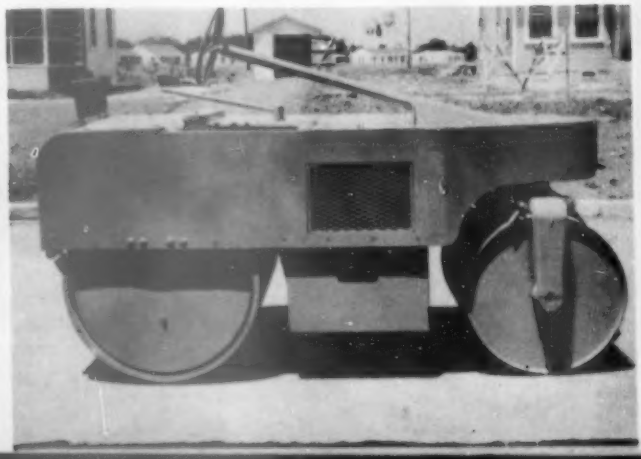


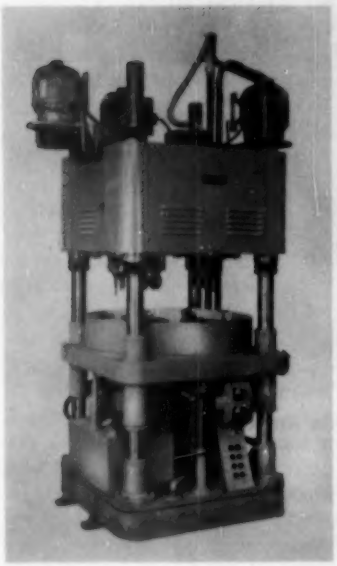
34. POSTWAR CAST IRON design weighs 1,782 lb

35. STREAMLINED arc welded mixer — weight 600 lb

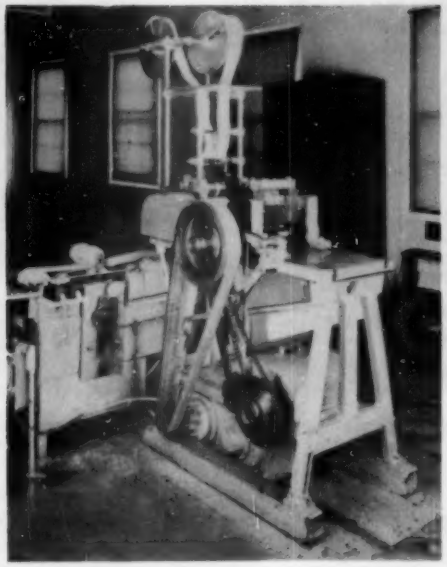
36. ROAD ROLLER design changed little through the years

37. HIGH CLEARANCE is a feature of this welded roller

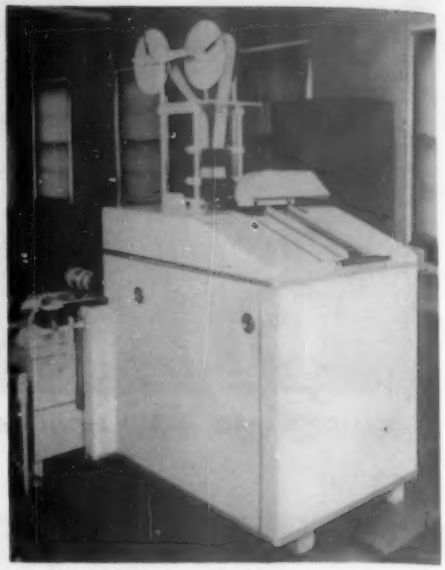




38. OIL RESERVOIR in the base is a feature of this 18-spindle automatic drill



39. DANGER LURKS around this open perforating machine



40. SAFETY and beauty come with a welded cover

Through welding there has been attained a product which will meet a highly competitive market in a satisfactory manner. The requirements could not have been accomplished with iron or steel castings because of strength and shape limitations.

The automatic drilling machine (Fig. 38) clearly pictures the manner in which welding was used in making a functional machine. The base, because of its leakproof welded construction can serve as an oil reservoir and thus increase the stability of the machine. Welded fabrication saved time and resulted in better appearance in the construction of this drilling unit. The vertical style affords easy tool adjustment and clear vision for the operator.

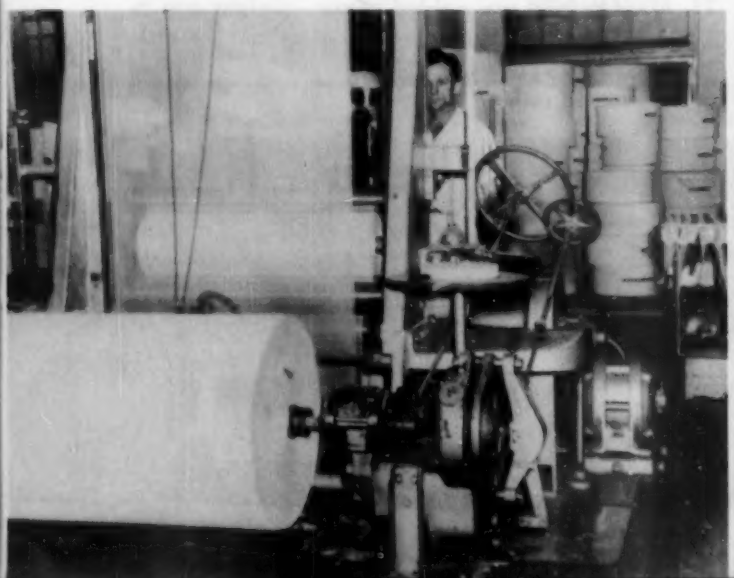
WELDING FOR BEAUTY

Besides serving many utilitarian purposes in the design or the redesign of industrial equipment, welding affords excellent opportunities to improve the appearance of a product. Sometimes an application of welding improves the overall appearance of the equipment; in other instances welding serves definitely to eliminate hazardous work conditions. As an example of the latter use, compare the old-style perforating machine in Fig. 39 with the perforating machine having a welded cover in Fig. 40. The application of welding has made possible cleaner and less hazardous working conditions.

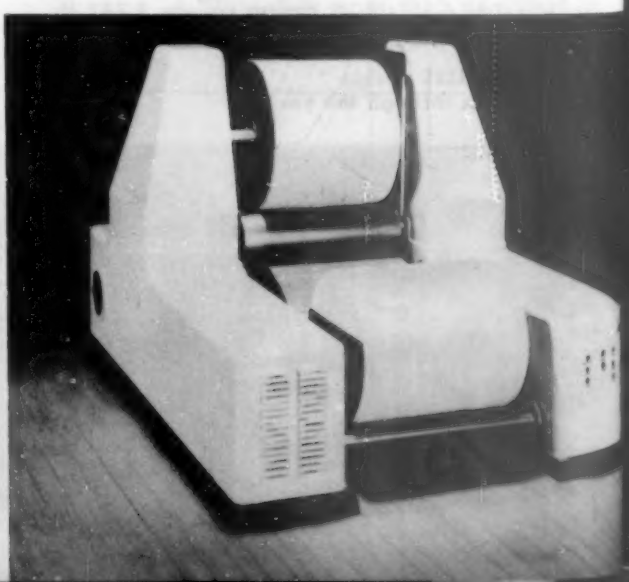
Another example, from the textile industry, is provided by the comparison of Fig. 41, an old-style cloth rewinder, with the welded redesigned cloth rewinder pictured in Fig. 42. Advantages of Fig. 42 are reduced hazards, reduced machine space and improved overall mill efficiency.

These are only a few of the examples of how cost may be reduced and quality improved through proper welded design. The engineer who will couple common sense with ingenuity can undoubtedly devise many other designs that will be equally or more pleasing in appearance, lighter in weight, more durable in construction and offer better operating efficiency.

41. CLOTH REWINDER of ancient design is clumsy, hazardous and hard to clean



42. HIGHER EFFICIENCY from modern, compact welded design

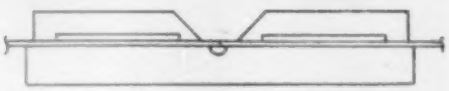


Fluxes for Inert-Arc Welding

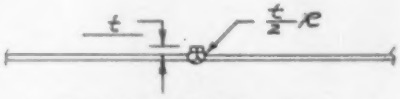
Unless the work can be properly jigged, it is more satisfactory to use a flux than an inert-gas back-up for thin-gauge flange and fillet joints. But what kind of flux?

BY RUSSELL MEREDITH

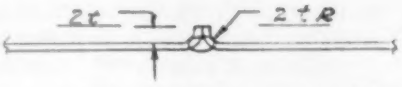
Northrop-Hendy Co., Hawthorne, Calif.



1—PROPER JIGGING for butt joints in thin-gauge material. Argon or helium may be introduced in the concavity just below the weld



2—FLANGE JOINT properly prepared. Fit-up is good, and the weld may be made without difficulties



3—POOR FIT-UP means weldor will have trouble with above flange joint, a type more frequently encountered than that of Fig. 2

MANUFACTURE of gas turbine and jet propulsion engines, chemical and food processing equipment and aircraft components calls for the fabrication of assemblies from sheet stainless steel and heat-resisting alloys, in gauges ranging from 0.010 to 0.080 in., by the inert-arc welding process. To minimize stresses and save finishing costs, it is desirable to have weld joints with 100% penetration and a drop-through reinforcing bead of smooth contour. This, however, is difficult to achieve in cases where joint preparation and fit-up are poor, and parts are not properly jigged.

Parts jigged as shown in Fig. 1 present no problem with either flange or butt joints. Welds will be smooth and sound. Little oxidation of the underside can occur because of the confined area in which air can encounter the molten drop-through metal. Let us suppose, however, that only one or two parts are to be built, and it is not practicable to use a jig. This brings up the question of joint design on unjigged parts.

FLANGE VS. BUTT JOINTS

Since butt joints on thin-gauge materials are difficult to tack weld and to keep straight during welding, the flange joint has been adopted. When properly prepared, this type of joint has several advantages over a butt joint. First, the abutting edges cannot lap over during tacking as is the case with unflanged joints; secondly, the seam will stay straighter during welding due to the bending stiffness of the flange. Lastly, but of great importance, the weld can be made without the use of a filler rod, which saves time and results in a smoother weld bead.

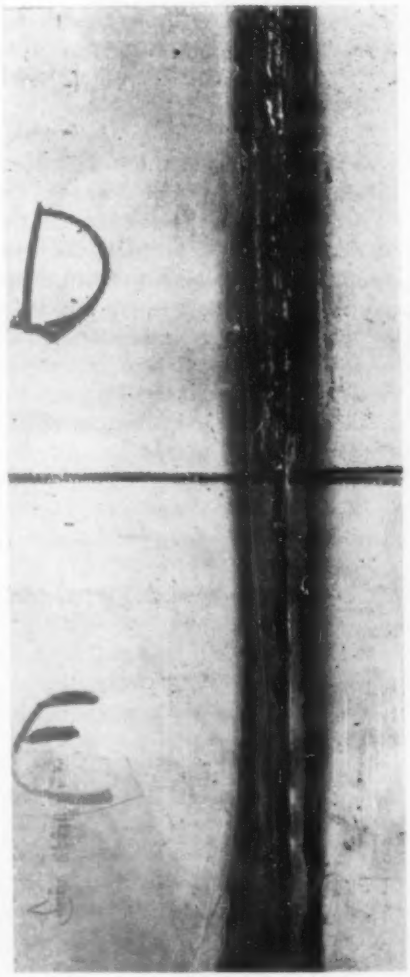
Proper preparation of a flange joint is shown in Fig. 2. Unfortunately, more times than not, when the flanged parts reach the weldor the joint will be as shown in Fig. 3. Moreover, the weld must have full penetration, as indicated by the ellipse in Fig. 3.

If he has had any experience at all, the weldor does not like this fit-up. Nevertheless, it is his job to try to weld the thing. He does so, and the results are nothing much to brag about. He will encounter hem-stitching and burn through; if he does manage to complete the weld it will be rough and of poor quality, with much more time consumed than necessary.

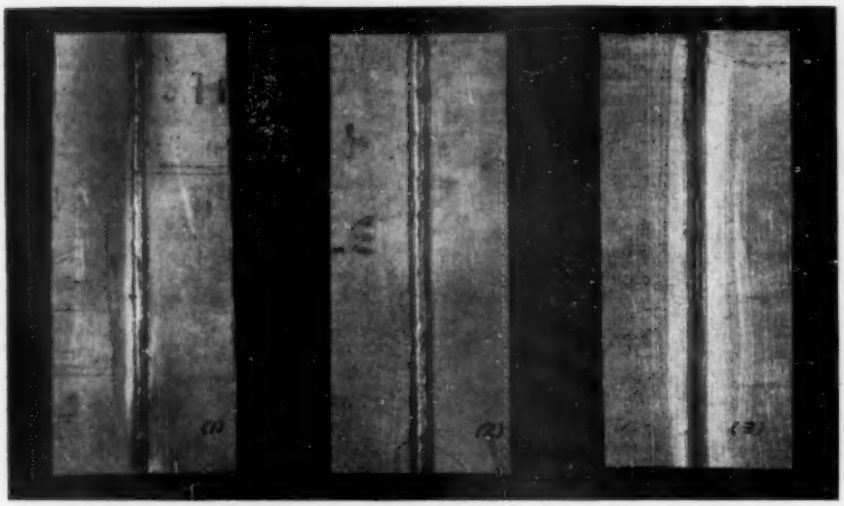
BACKING WITH GAS

The reasons the weldor has trouble with this joint are: (1) because of oxidation occuring and preventing fusion at the weld root, and (2) there is no support for such a large mass of molten metal.

The inert gas used in the holder will prevent the top surface of the joint from becoming oxidized. The same treatment can be given to the undersurface by either piping the inert gas into a trough under the weld or by having a helper blow the gas through a tube under the molten weld puddle. These methods, if applied properly, will work very nicely but will work only in a small confined space. It does not matter how much gas you use. For instance, if you had a tank to weld and were to fill it with argon or helium, you would find that there



4—STAINLESS-STEEL sheets were fluxed in section D, unfluxed in E. This view of underside shows marked difference in the results



5—COMPLETE PENETRATION was obtained with the flux-backed specimens, sections 1 and 2. Unfluxed section 3 shows incomplete penetration. Material is stainless "W," type 322. All of the welds were automatic

6—ROOT BEAD before (A) and after (B) removal of flux in flange joints on 19-9 DL stainless

was too much air dilution for the gas to function as a back-up. Unless the parts are jigged in some such manner as Fig. 1, the gas backing method becomes impracticable and prohibitive from a cost standpoint.

Can We Use Flux?

The next best method is to use a flux along the bottom edges of the seam to prevent oxidation of the undersurface and promote root fusion. A neat trick—if you can do it. Not just any old flux will do. Since many different processes take place under the arc during welding, the flux must be carefully compounded to meet the following qualifications:

(1) It must not cause arc disturbance.

(2) It must be quite fluid at a low temperature in order to give good coverage.

(3) It must have a low specific gravity.

(4) It must have sufficient strength when fused to support the molten metal from excessive sagging on poorly fitted joints.

(5) It must have a reducing action on the oxides of chromium, nickel and iron.

(6) It must not cause cracking or wormholes in the weld deposits.

The above list of requirements sounds like a big order. Every one of these items, however, is very important. For instance, some fluxes we have tried out have good supporting characteristics but will become trapped in the molten puddle, and others are fluid enough not to cause this trouble but are lacking in other qualities which make for good welding conditions.

In order to determine the usefulness of flux as a means of speeding up production, saving on the cost of gas backing and obtaining better welds on parts with poor fit-ups, the Northrop-Hendy Co. conducted tests on a number of fluxes with samples of stainless steel and heat-resisting alloys. Five types of materials were welded: (*a*) 18-8 stainless steel, type 321, 0.040 to 0.060 in. thickness; (*b*) stainless "W," type 322, 0.024 in.; (*c*) 19-9 DL stainless steel, 0.040 in.; (*d*) NI55 alloy, 0.027 in.; (*e*) Inconel, 0.050 in.

To maintain uniform results in testing, an automatic inert-arc welding head was used with speeds of 6 to 12 ipm. Two types of equipment were employed: a 200-amp a-c-welder with high-frequency attachment and a 200-amp d-c welder.

Undersides of welds made with various fluxes are illustrated in Figs. 4 to 9, inclusive. Some of the fluxes allowed burn-through, while others gave poor coverage. Ten commercial fluxes and thirty experimental mixtures were tested.

Fluxed-Unfluxed Specimen

Fig. 4 shows an 18-8 type 321 stainless specimen which was made with a flanged joint normally encountered in the run-of-the-mill production. This specimen was fluxed half way (upper half) with a proprietary flux.* The results are obvious—hemstitching and burn-through occurred until the fluxed area was reached, at which time the weld went smoothly and good penetration was obtained.

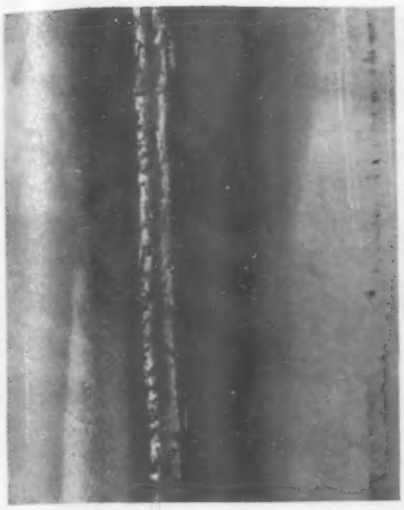
Fig. 5, sections 1, 2 and 3, shows the undersurfaces of three specimens welded from stainless "W" type 322 material. Section 3 is an unfluxed joint with incomplete penetration. Due to the sluggishness of this material, it is quite difficult to obtain 100% penetration without the aid of flux to promote root fusion. Sections 1 and 2 welded with flux have 100% penetration.

Fig. 6, section A, shows the root bead before flux removal. Section B shows it after removal of flux from a flange joint made on 19-9 DL stainless alloy.

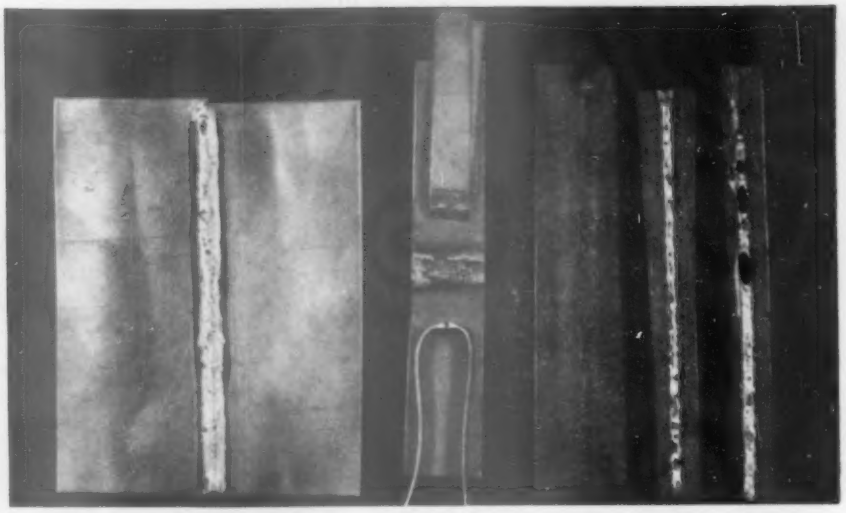
The cracked weld in Fig. 7 is the result of using an inferior flux. This flux not only caused cracking but fused into a glass that was very difficult to remove.

Fig. 8 pictures five specimens of three different alloys: Inconel on the left, 19-9 DL stainless alloy in the center and NI55 alloy on the right. The Inconel specimen shows a good drop-through bead. The 19-9 DL specimen in the center has wormholes (gas pockets) in the weld deposit caused by use of an inferior flux. The NI55 alloy specimen on the extreme right was welded with a flux which did a good

*"Heliflux" furnished through the courtesy of Renfro Products Co., 2417 Porter St., Los Angeles.



7—CRACKED WELD caused by use of an unsuitable flux. Glassy slag produced is difficult to remove



8—TEST SAMPLES of different alloys: Inconel (left), 19-9 DL stainless (center) and NI55 alloy (three on right). The 19-9 specimen has wormholes. Of the three NI55 specimens, only the middle one shows a good weld

job of absorbing oxides but had poor supporting qualities for the molten drop-through metal. The one in the middle is a good weld, while the one on the left was welded without flux and has incomplete fusion.

Fig. 9 shows the undersides of nine welds made with different fluxes. Nos. 1 and 8 were fair fluxes, but No. 9 was the best, taking into consideration all qualities required of a good flux. The bead pattern was not disturbed as in the case of Nos. 1 and 8. From a deoxidation standpoint, Nos. 8 and 9 were equal. From the flux-removal standpoint, the flux from No. 9 specimen—having a high differential expansion—was easily removed and left the weld metal bright and clean. Some fluxes have an enameling action and are difficult to remove.

Flux-Removal Methods

Flux removal is always somewhat of a problem; however, it need not be one of major importance if care is exercised in mixing the flux and applying it properly.

Some of the methods for removing flux are fused caustic soda, sandblasting or hydroblasting and acid cleaning with a solution of 20% nitric, 5% hydrochloric and 75% water at 140 F. The acid method is somewhat slow. These drastic treatments need not be necessary. If the proper flux has been properly applied, a few bumps with a hammer will drive off most of the fused slag, and the remainder can be removed with a wire brush.

Fillets in Thin Gauges

A valuable use for flux which should not be overlooked is in the welding of thin-gauge tubing or fittings to tanks. It is, for example, difficult to make a fillet weld to join a tube of ½-in. OD and 0.030-in. wall thickness to the head or side of a thin-gauge tank. Moreover, cracking and distortion would be likely to occur if the weld were made on this thin-gauge material. A very simple way to do it is to drill a hole in the tank the size of the tube OD, insert the tube, flux the outside of both tube and tank and then weld from the inside. The flux will draw the weld metal through to form an outside fillet. The whole operation can be done faster and easier without the aforementioned fillet welding difficulties.

9—NINE WELDS with different fluxes. No. 9 is best weld from standpoints of bead pattern, deoxidation, and flux removal. Nos. 1 and 8 are fair

A Pig with a

In pipe-line parlance, a unit designed to move within a pipe bore is known as a "pig." The superspecial pig described here carries equipment for X-ray inspection

BY ELTON STERRETT

CRADLE CONTAINING X-ray "pig" is held against open end of the pipe to be tested. The star-wheel telltale rests against pipe top

CONTROL PANEL includes rheostat for motor control and switches to safeguard energization of X-ray transformer. Signal light indicates contact of telltale with weld

DEVELOPMENT of a mobile X-ray source designed to move within a pipe bore has opened new possibilities for checking welds in high-pressure gas or oil trunk lines. The "pig," as the unit is known, is mounted on a motor-driven chassis and carries a transformer and X-ray tube. It is controlled by a simple panel from the open end of the line and is equipped with a clever device to indicate presence of a weld.

The weld detector or telltale is a four-node star wheel held by spring tension against the inner wall of the pipe. It slides freely over smooth pipe, but contact of the forward node against a weld causes the wheel to revolve through 90 deg. This action actuates a signal light on the panel and also produces a loud click. The above activity of the telltale indicates the presence of a weld and also that the X-ray tube has been centered within the circle of the weld. The transformer is then energized to activate the tube, and the weld is X-rayed. Exposure time depends upon wall thickness, 2½ minutes being required for pipe of $^{9}/_{32}$-in. thickness.

The pig is mounted on four gear-driven rubber-tired wheels, set in pairs at approximately 120 deg around the circumference of the pipe. A third pair of wheels on a spring-mounted arm centers the device and maintains the tube in the center of the pipe regardless of any spiraling that may take place as the unit moves down the line. The mobile X-ray unit, of which the pig is only a part, carries a crane to place the pig and carry it between jobs.

Since the pig is driven by a synchronous motor, the operator at the end can spot the position of the device quickly by checking travel against a stop watch. One minute 8 seconds was the average travel for a joint on a recently X-rayed 26-in. line.

SAFETY ASSURED

Three control units regulate use of the X-ray tube, providing safeguard against its being accidentally energized and possibly subjecting personnel to danger from X-rays. The tube is shielded except for the area used to cover the weld. As

FILM is in a stainless-steel holder within a rubber sheath and is backed with lead strips for safety

MOBILE X-RAY UNIT carries a crane for placing the pig, also a darkroom in the cab. The rearward projection of cab is for film drying. A separate engine and generator provide power for pig motor and transformer

an X-Ray Eye

weld checking is done after the welding spread has gone on ahead and before the cleaning, priming and wrapping gangs have come up, only the operator of the pig is in the vicinity of the tube at the time it is active.

Exposed film is developed in a portable darkroom, carried in the cab of the mobile unit. Wet film is available for inspection after 15 minutes, a dried film shortly thereafter. A rearward projection from the cab is provided for film drying.

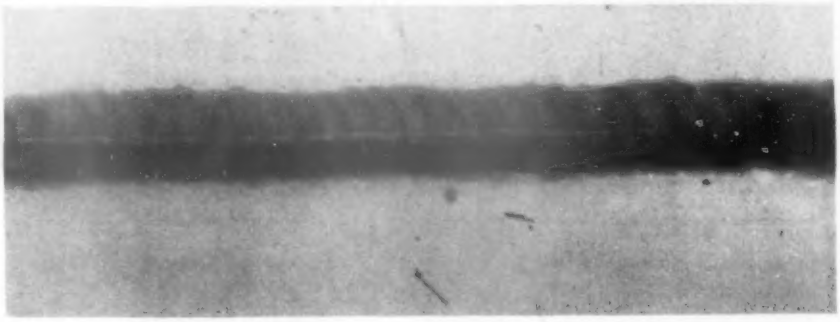
On the 26-in. pipe line, at least one weld per weldor per day was X-rayed. Welds were chosen at random by the welding inspector and marked for checking before the X-ray unit arrived. With a new weldor, it might prove desirable to check every weld until his dependability had been established; similar thorough checking might be specified on river crossings or lines laid through residential or business areas where a leak would be extra serious or replacement difficult.

The 26-in. line from which the illustrations were taken is part of a gas trunk system loop costing around $15 per running foot. Weld inspection is economical insurance when compared with other laying costs. Practice on this line calls for inspection of 10% of the welds. Around 20 welds are inspected per day when 8,000 feet of pipe are laid.

Weld Reference Marks

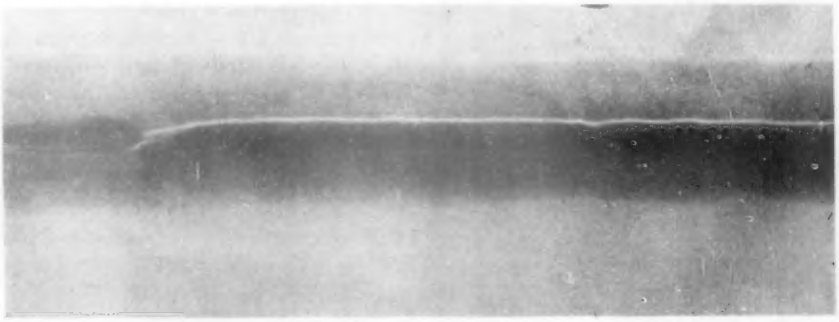
A 2⅜-in. strip of film photographs the weld full size, and enables a skilled observer to detect undercutting, slag inclusions, cracks, burning and other defects which disqualify a weld—or weldor—for high-pressure service. The 26-in. line uses seam-welded pipe, and the longitudinal seam provides quick orientation of the exposed film. On seamless pipe, a number perforated through a lead plate is centered at the top diameter of the pipe to number the weld and provide a reference point. In most instances, the film is readily spotted on the weld.

GOOD WELD, although slightly narrower than desired, with uniformly deposited weld metal. Heavy black vertical line is the longitudinal seam

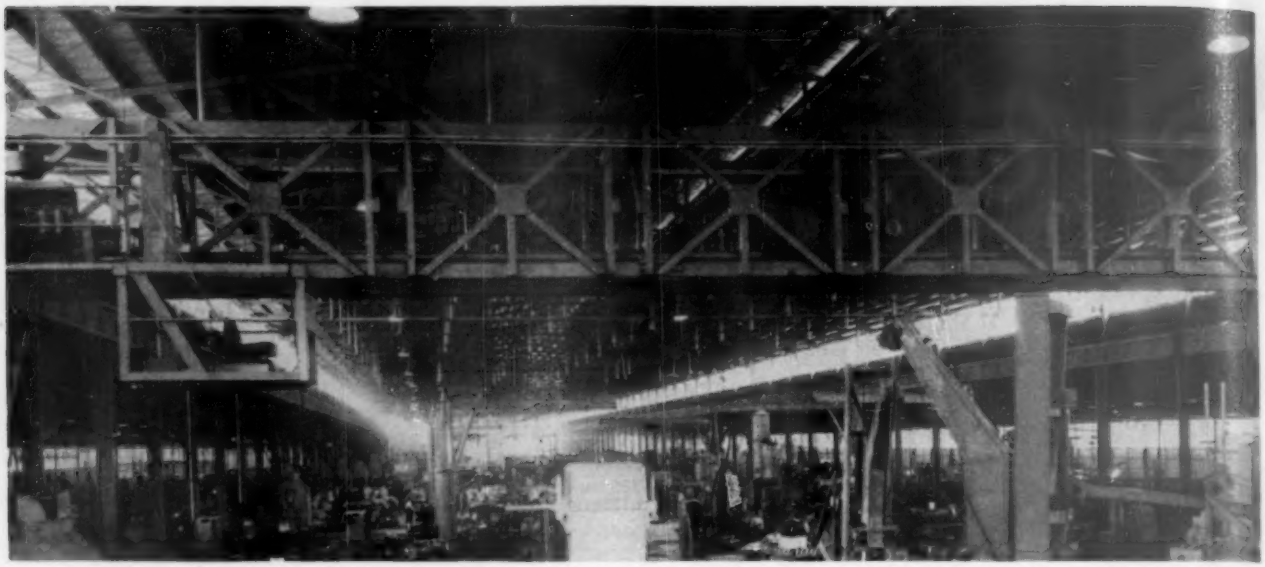


SLAG INCLUSION between stringer and filler beads is shown by light line through weld. Black dot below weld is where weldor struck his arc

GAP IN STRINGER BEAD, nearly an inch long, is shown toward center of this radiograph. Filler and finisher beads were laid on satisfactorily



CRACK (light line) is a bad defect revealed by X-rays. It extends from gap in stringer bead into area of contact between stringer and filler beads



1—OVERHEAD CRANE is of 100-ton capacity. It obtains its great structural strength from welded box sections

Welded Cranes and M

Overhead cranes, jib cranes, monorails and other permanent fixtures were installed as the roof and floor areas were enlarged at the LeTourneau Longview, Texas, plant. By the time the new factory building was completed, it had already produced a good amount of its major product

BY WALTER J. BROOKING

Dean, LeTourneau Technical Institute

A previous article* discussed the construction of the LeTourneau Corporation's new building at Longview, Tex. This factory for earth-moving equipment was built in the form of a center section with two side bays. The center section is 1,000 ft long by 108 ft wide. A 100-ton overhead crane spans the 108-ft width and travels the entire length of the building with an under-clearance of about 25 ft. The overhead crane rails were set in offsets provided at the upper ends of the center upright girders.

Fabrication of the overhead crane (Fig. 1) began soon after the first center roof section had been completed. The crane was designed with a long wheel base which distributes the load over a long section of the crane rail and, therefore, over a long section of the basic footing. It obtains its great structural strength with relatively light weight by means of box sections fabricated by welding.

Crane Rail Construction

The overhead crane rails (Fig. 2) were fabricated from two Z-sections similar to those which were used in the main upright for the center trusses. Two Z-sections were used, and a relatively deep and thin section of steel strip was welded in to complete the box. Upright reinforcements and stiffeners were placed appropriately in the fabrication of the box section, and a piece of railroad rail furnished the actual bearing surface for the crane wheels. The overhead crane rail box sections were fabricated on the floor, were raised separately and were welded solidly in place at the offset in the main center truss-supporting upright.

The overhead crane is powered by a 200-hp Diesel engine. The Diesel drives a generator, which in turn drives separate electric motors (manufactured by LeTourneau) on each drive wheel and on the drive wheels of the cross carriage as well as the hoist.

Jib Cranes and Monorails

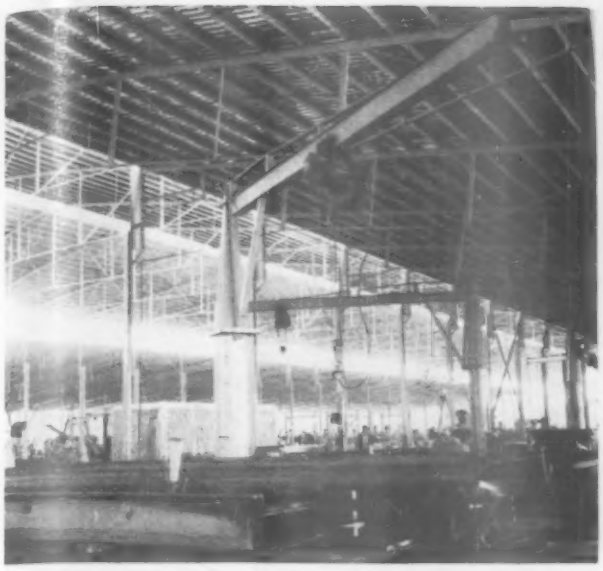
The jib cranes, such as the one shown in the background in Fig. 2, are of standard LeTourneau manufacture and were placed prior to pouring the concrete for the section of the floor in which they set.

Monorails were installed at appropriate locations as the building was completed. In Fig. 3, note the lightweight welded construction. A standard I-beam was used for the rail supporting the hoist and carriage. These monorails serve well to load gears and other heavy parts into machines, or to move them from machine to machine in a sequence of operations in the production line. They are very simple, may be economically constructed as part of the welded factory and provide inexpensive transportation within the limits of their application.

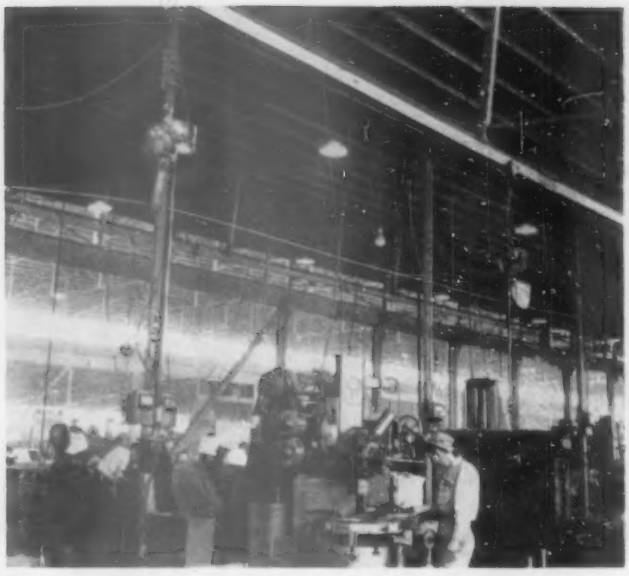
Piping Installation

Another important part of the permanent or semipermanent fixtures

*"Welding Beats the Steel Shortage," The Welding Engineer, September, 1948.



2—CRANE RAILS were fabricated on floor and raised



3—MONORAIL system provides flexible transportation

d Monorails

in the new LeTourneau factory is the piping. Fig. 4 shows the natural gas manifold outside of the main factory building. It is entirely of welded construction, and the fence which encloses it is also of durable welded construction.

Only to mention other applications, the gas piping within the plant and the hydraulic oil piping for hydraulic systems, used for semiautomatic lathes and other hydraulic units, were welded; mostly by arc, some by gas. Costs were reduced by the elimination of threaded fittings, and a more flexible installation, which involves fewer pounds of pipe, was provided. Appearance was also better, due to the contour and smooth surfaces of the welded joint as contrasted with the flanged, bolted or screw-type fittings which might have been used instead.

The hydraulic fluid tank shown in Fig. 5 was also welded, as were the compressed air tanks and other permanent storage tanks.

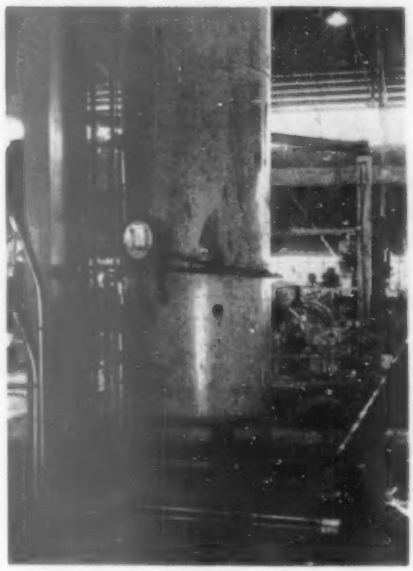
Grinding Wheel Racks

Another simple example of the permanent or semipermanent fixtures in the factory is shown in Fig. 6. The racks for grinding wheels in the toolroom and the enclosing fence (made of angles and heavy wire netting) were both fabricated by welding. The use of arc welding provides an easy and economical means of making strong, lightweight racks and storage bins to fit particular needs. The building of enclosures for toolrooms, tool cribs, warehousing areas and similar restricted areas by means of heavy netting and steel shapes is also very economical and very effective.

Produced while Building

Slightly over a year was required to build this factory. The fitting and tooling were completed at the same time as the floor and roof area were enlarged. By the time the building had been completed, the factory had produced and sold a very creditable amount of its major product.

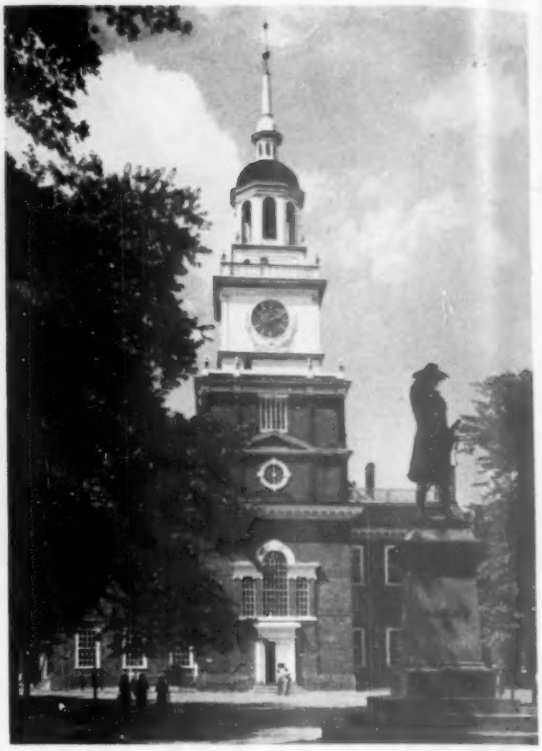
4—GAS PIPING such as this inlet manifold was entirely arc welded. So also was the retaining fence



5—HYDRAULIC oil tank, air tanks and other permanent storage tanks were likewise welded

6—GRINDING WHEELS may be conveniently stored on this welded rack, made from materials at hand

It's Philadelphia



Following the precedent set by Republicans, Democrats and Progressives, the 29th annual convention of the American Welding Society will be held in the City of Brotherly Love

BY CLYDE B. CLASON

MEETING in the shadow of Independence Hall, members of the American Welding Society hold their 29th annual convention at the Bellevue-Stratford Hotel, Philadelphia, October 24 to 29 inclusive. The meetings will be held concurrently with the National Metal Congress and Exposition (see page 70), which is this fall celebrating 75 years of progress in the development of alloy steel.

Convention Calendar

Convention week opens in the traditional fashion with the President's Reception. This pleasant social event will be held Sunday afternoon from 5 to 7 p.m. in the Burgundy room of the Bellevue-Stratford.

Three simultaneous technical sessions open on Monday morning, Oct. 25, at the South Garden, North Garden and Rose Garden rooms of the Bellevue-Stratford and will continue in these same three rooms on Tuesday morning, Tuesday afternoon, Wednesday morning, Wednesday afternoon, Thursday morning and Friday morning. The morning sessions start at 9:30 a.m.; the afternoon sessions at 2:00 p.m. All technical sessions will positively start on time, the convention committee promises.

Monday and Thursday afternoons will be left free to permit AWS members to attend the National Metal Exposition at the Commercial Museum and Convention Halls. The exposition will be open from 12 noon to 10:30 p.m. on Monday, Tuesday and Wednesday and open from 10:00 a.m. to 6:00 p.m. on Thursday and Friday. Many new products and processes will be shown for the first time, and, as usual, welding and cutting exhibits and demonstrations will be prominently featured.

Monday evening, beginning at 8:00 p.m. in the Rose Garden, will be devoted to the awards of prizes and medals, including the Samuel Wylie Miller Memorial Medal, the Lincoln Gold Medal, the Resistance Welder Manufacturers' Association prize contest awards and the A. F. Davis Undergraduate Welding Award program. H. O. Hill, the retiring president of the American Welding Society, will act as chairman of this important meeting, and E. V. David, chairman of the convention committee, will serve as co-chairman.

Adams Lecture

The annual Adams lecture will also be given on Monday evening, immediately following the presentation of the awards and prizes. This year's lecturer is G. E. Claussen, metallurgist, Reid-Avery Co., who speaks on the metallurgy of covered electrode weld metal.

The Adams lectureship is now five years old, being created in 1943 in honor of Dr. Comfort A. Adams, founder and first president of the American Welding Society. The first Adams lecture was given by Dr. Adams himself, who, as members who attended the Chicago convention of 1943 may recall, detailed some important work done in connection with the quantitative analysis of the electrical and thermal factors involved in resistance welding.

Other Adams lecturers and their subjects have been:

1944—Dr. A. B. Kinzel, vice-president Electro Metallurgical Co. and chief metallurgist, Union Carbide and Carbon Research Laboratories, Inc., "Solid-Phase Welding."

1945—Dr. Samuel L. Hoyt, technical advisor, Battelle Memorial Institute, "Selection of Steels for Welding."

1946—Dr. Wendell F. Hess, professor in metallurgical engineering and head of the weldng laboratory Rensselaer Polytechnic Institute, "New Frontiers in Welding."

1947—G. S. Mikhalapov, manager, apparatus research department, Air Reduction Sales Co., "Structural

New AWS Officers

G. N. SIEGER, of Detroit, will become next president of AWS

O. B. J. FRASER, first vice-president for the 1948-49 term

H. W. PIERCE will take office as the second vice-president

Strength of the Welded Joint."

Mr. Claussen should prove a worthy addition to this distinguished company of engineers and scientists.

Other special events of the week are the section officers' conference and university conference, both on Wednesday evening at 8:00 p.m., and the annual dinner on Thursday evening in the Rose Garden. The business session at 2:00 p.m. and the board of directors' meeting at 3:00 p.m. bring the convention to a close on Friday afternoon.

Details of the entertainment for the ladies have not yet been announced, but the fair visitors will be assured of a royal good time if past experience is any criterion.

Technical Program

According to the association's tentative program (see pages 62 and 63), there will be 21 technical sessions at which a total of 68 papers will be presented. Ships receive a lion's share of the allotted time. There will be a session on ship design (Monday morning) and two symposia on ship structure research (Tuesday morning and afternoon).

Railroads receive very nearly as much attention. Railroad sessions will be held on Monday and Tuesday mornings, and an open meeting of the railroad committee has been scheduled for Tuesday afternoon.

A session on storage tanks, pressure vessels and piping will be held on Monday morning, a structural session on Thursday morning and a maintenance session on Thursday morning.

Nine of the 21 technical sessions will be given over to specific welding and related processes. These include a session on brazing and metallizing on Tuesday afternoon, two cutting sessions on Tuesday afternoon and Wednesday morning, two resistance-welding sessions on Wednesday morning and afternoon, two sessions on inert-gas-shielded arc welding Wednesday afternoon and Thursday morning, a session on automatic welding on Friday morning and another Friday session on hard-facing and flame-hardening.

Three sessions are also scheduled on primarily research subjects: a session on high alloys on Tuesday morning, a session on weldability Wednesday morning and a session on arcs and electrodes Wednesday afternoon. Subjects of such widely varying appeal as ceramic and composite back-ups for grooved weld joints, fabrication of shipping containers, design of farm equipment and the evaluation of effects of residual stresses will be lumped together in a miscellaneous section on Friday morning.

New Officers

The 1948 nominating committee has proposed the following candidates for office during the 1948-1949 term:

President: G. N. Sieger, president and general manager, S-M-S Corp., Detroit.

First vice-president: O. B. J. Fraser, assistant manager, development and research division, The International Nickel Co., Inc., New York City.

Second vice-president: H. W. Pierce, assistant to general manager, New York Shipbuilding Corp., Camden, N. J

Directors at large: J. J. Chyle, director, welding research, A. O. Smith Corp., Milwaukee; J. H. Humberstone, director, research and welding engineering, Arcrods Corp., Sparrows Point, Md.; T. B. Jefferson, editor, The Welding Engineer, Chicago; H. N. Simms, metallurgist, Black, Sivalls & Bryson, Inc., Oklahoma City, Okla.

District vice-presidents: G. E. Claussen, metallurgist, Reid-Avery Co., Inc., Baltimore, District No. 2 (mid-eastern); F. L. Plummer, director of engineering, Hammond Iron Works, Warren, Pa., District No. 4 (central); R. L. Townsend, partner, Tweco Products Co., Wichita, Kan., District No. 6 (mid-southern).

29th AWS Meeting P

Monday, October 25

9:30 A. M.—Simultaneous Technical Sessions

SHIP DESIGN
(South Garden)

H. W. Pierce, New York Shipbuilding Corp., chairman; R. L. Deily, Bethlehem Steel Co., co-chairman.
"New Factors to Be Considered in the Design and Welding of Ships," by Milton Forman, United Engineering Co.
"Riveted vs. Welded Structure," by E. M. MacCutcheon, David Taylor Model Basin.
"Repair of Welded Ships," by L. E. Bledsoe, Newport News Shipbuilding & Drydock Co.

RAILROAD
(North Garden)

J. W. Sheffer, American Car & Foundry Co., chairman; A. J. Raymo, The Baldwin Locomotive Works, co-chairman.
"Submerged-Arc Welding of Box and Hopper Cars," by E. A. Watson, American Car & Foundry Co.
"Welding the Modern Diesel Locomotive," by H. S. Swan, American Locomotive Co.
"General Welding Practices in Locomotive and Car Shops," by J. Michne, New York Central System.

STORAGE TANKS, PRESSURE VESSELS, PIPING
(Rose Garden)

A. C. Weigel, Combustion Engineering Co., chairman; E. B. Stolle, Midwest Piping & Supply Co., co-chairman
"Field-Erected Storage Tanks of Aluminum," by Fred L. Plummer, Hammond Iron Works.
"Standardization of Welded Chemical Process Tanks," by J. G. Henderson, Carbide and Carbon Chemicals Corp.
"Sampling of Welds by Trepanning and Allied Methods," by R. B. Lincoln, Pittsburgh Testing Laboratory.
"Pipe Welding," by John H. Zink, Heat & Power Corp.

Monday—8:00 P. M.—Prize Awards, Adams Lecture
(Rose Garden)

H. O. Hill, president, American Welding Society, chairman; E. V. David, chairman Convention Committee, co-chairmen.
"The Metallurgy of Covered Electrode Weld Metal," by G. E. Claussen, Reid-Avery Co.

Tuesday, October 26

9:30 A. M.—Simultaneous Technical Sessions

SYMPOSIUM ON SHIP STRUCTURE RESEARCH
(South Garden)

Captain L. V. Honsinger, U. S. N., chairman and chairman, Ship Structures Committee; J. Lyell Wilson, American Bureau of Shipping, co-chairmen.
"Explosion Tests," by G. S. Mikhalapov, Air Reduction.
"A Detailed Study of Welded Joints by Means of the Static Notch Bar Eccentric Tensile Test," by George Sachs, L. J. Ebert and A. W. Dana, Case Institute of Technology.
"Development of a Small Welded Specimen to Predict Transition Temperature of a Full-Scale Welded Structure," by C. B. Voldrich, Battelle Memorial Institute.
"Fracture Characteristics of Ship Plate in Certain Small Scale Tests," by E. P. Klier, F. C. Wagner and M. Gensamer, The Pennsylvania State College.

RAILROAD
(North Garden)

A. G. Oehler, railway mechanical engineer, chairman; L. E. Grant, Chicago Milwaukee, St. Paul & Pacific R. R. Co., co-chairman.
"Diesel Locomotive Welding," by R. L. Rex, Air Reduction.
"Unionmelt and Heliarc Welding of Railroad Car," by C. R. Strutz, The Oxweld Railroad Service Co.
"Welding Practice in Welding AISI Specification 430 (18% Chrome Steel) in Locomotive Fire Box Applications," by Howard L. Miller, Republic Steel Corp.
"Railroad Car Welding," by A. M. Unger, Pullman-Standard.

HIGH ALLOYS
(Rose Garden)

O. B. J. Fraser, The International Nickel Co., chairman; R. H. Aborn, United States Steel Corp., co-chairman.
"The Effect of Weld-Metal Composition on the Strength and Ductility of 15% Cr-35% Ni Welds," by David Rozet, Hallock C. Campbell and R. David Thomas, Jr., Arcos Corp.
"Welding Alloy Steels in Oil Industry," by M. E. Holmberg, Phillips Petroleum Co.

2:00 P. M.—Simultaneous Technical Sessions

SYMPOSIUM ON SHIP STRUCTURE RESEARCH
(South Garden)

Commander R. D. Schmidtman, U. S. Coast Guard, chairman; Finn Jonassen, National Research Council, co-chairman.
"The Development of Weldable High-Strength Steels," by C. E. Sims, Battelle Memorial Institute.
"The Testing of Highly Restrained Welded Structural Joints Made from High-Strength Steel," by A. Boodberg and Earl R. Parker, University of California.
"The Evaluation of Notch Sensitivity Characteristics of Steel by the Tear Test Method and Its Application to Quality Control of Ship Plate," by Noah A. Kahn and Emil A. Imbembo, New York Navy Yard.

BRAZING AND METALLIZING
(North Garden)

J. R. Wirt, Delco-Remy Division, GMC., chairman; G. W. Oxley, Standard Oil Development Co., co-chairman.
"Low-Temperature Silver-Alloy Brazing of Copper-Beryllium Alloys," by A. M. Setapen and W. D. Warren, Handy & Harman.
"Low-Temperature Brazing Technique," by R. E. Ballentine, Westinghouse Electric Corp.
"Metallizing as a Production Process," by Knowles B. Smith, Dix Engineering Co.

CUTTING
(Rose Garden)

H. B. Seydel, Air Reduction Sales Co., chairman; E. R. McClung, Lukenweld, Inc., co-chairman.
"Powder Cutting and Scarfing in the Steel Industry," by Frank A. Snyder, Carnegie-Illinois Steel Corp.
"New Controls for Mechanized Gas Welding and Cutting Equipment," by W. J. Greene, R. B. Steele and H. G. Hughey, Air Reduction Sales Co.
"The Stability of Oxyacetylene Flames," by L. D. Conta, Air Reduction Sales Co.

Wednesday, October 27

9:30 A. M.—Simultaneous Technical Sessions

WELDABILITY
(Rose Garden)

Clarence E. Jackson, Union Carbide and Carbon Research Labs., chairman; R. E. Somers, Bethlehem Steel, co-chairman.
"Strain Aging in Welding Low-Carbon Structural Steel," by W. H. Bruckner and W. E. Ellis, University of Illinois.
"An Evaluation of the Influence of Chemical Composition of the Base Metal upon the Performance of Metal-Arc Welded Joints," by J. Heuschkel, Westinghouse Electric Corp.

Program

"Notch Toughness of a Variety of Welded Low-Carbon Steels," by Dr. E. F. Nippes, Jr., and Warren F. Savage, Rensselaer Polytechnic Institute.
"Weldability of Cast Carbon and Alloy Steels," by Sidney Low and V. T. Malcolm, The Chapman Valve Mfg. Co.

CUTTING
(North Garden)

A. B. Gordon, The Linde Air Products Co., chairman; R. D. Thomas, Arcos Corp., co-chairman.
"Specialized Steel-Mill Cutting Machines and Controls," by R. F. Helmkamp and A. H. Yoch, Air Reduction Sales Co.
"Corrosion Resistance of Powder-Cut Stainless Steels," by L. F. Stark and C. R. Bishop, Union Carbide and Carbon Research Labs., Inc.
"Structural I-Beam Cut-Off Machine," by G. J. Strate, Air Reduction Sales Co.

RESISTANCE WELDING
(South Garden)

G. N. Sieger, S-M-S Corp., chairman; K. W. Ostrom, K. Wm. Ostrom & Co., co-chairman.
"The Resistance-Welding Characteristics of the Dry-Disc Rectifier Welder," by R. H. Blair and C. E. Smith, The Taylor-Winfield Corp.
"The Importance of Temperature Measurements in the Establishment of Optimum Flash-Welding Conditions," by R. M. Curran, P. Patriarca and W. F. Hess, Rensselaer Polytechnic.
"Resistance Welding of Cross Wires," by R. C. Jones, The Taylor-Winfield Corp.
"Thermal Resistance of Metal Contacts," by W. B. Kouwenhoven, dean of School of Engineering, and J. H. Potter, assistant professor M. E., The Johns Hopkins University.

2:00 P. M.—Simultaneous Technical Sessions

ARCS AND ELECTRODES
(Rose Garden)

J. H. Deppeler, Metal & Thermit Corp., chairman; J. H. Humberstone, Arcrods Corp., co-chairman.
"Effect of Retained Gases on Weld-Metal Properties," by G. T. Motock, The Champion Rivet Co.
"Arc Phenomena with Electrodes Moving at High Speeds," by W. B. Kouwenhoven, dean of School of Engineering, and T. B. Jones, assistant professor E. E., Johns Hopkins University.
"An Investigation of Methods for Evaluating Welding Arc Stability and Their Application," by Prof. R. A. Wyant, Dr. Lauriston P. Winsor, and L. M. Schetky, Renssalaer Polytechnic Institute.

INERT-GAS-SHIELDED ARC WELDING
(North Garden)

H. E. Rockefeller, The Linde Air Products Co., chairman; Walter Mehl, Heintz Manufacturing Co., co-chairman.
"Characteristics of Inert-Gas-Shielded Welding Arcs," by G. J. Gibson and G. R. Rothschild, Air Reduction Sales Co.
"Design Features of Inert-Gas-Shielded Arc Welding and Control Equipment," by N. E. Anderson, Air Reduction Sales Co.
"Inert-Gas Arc-Welding Equipment," by E. F. Steinert and C. S. Williams, Westinghouse Electric Corp.

RESISTANCE WELDING
(South Garden)

O. C. Frederick, General Electric Co., chairman; B. L. Wise, National Electric Welding Machine Co., co-chairman.
"Preliminary Test of Spot-Weld Shunting in 24-ST Alclad," by A. R. Hard, State College of Washington.
"Projection Welding," by W. F. Hess, Rensselaer Polytechnic.
"Spot-Welding Schedules for Nickel and Nickel Alloys," by F. G. Harkins, Solar Aircraft Co.

Thursday, October 28

9:30 A. M.—Simultaneous Technical Sessions

STRUCTURAL
(Rose Garden)

W. E. Hendricks, Belmont Iron Works, chairman; Van Rensselaer P. Saxe, consulting engineer, co-chairman.
"Welded Bridges," by LaMotte Grover, Air Reduction Sales Co.
"Fabrication of Structural Steel Sections by Submerged-Melt Welding," by J. W. Tippett, The Linde Air Products Co.
"Flexible Beam and Girder Connections in a Large Welded Structure," by Harry Greaves, The Atlantic Refining Co.

INERT-GAS-SHIELDED ARC WELDING
(North Garden)

R. F. Wyer, General Electric Co., chairman; G. O. Hoglund, Aluminum Company of America, co-chairman.
"Heliwelding," by A. N. Kugler and H. A. Huff, Jr., Air Reduction Sales Co.
"Welding Pure Copper for Pressure Vessels to ASME U-69 and Case 934 with Heliarc Process," by John W. Mortimer, Whitlock Mfg. Co.
"Production Heliwelding of Stainless Steel," by Newton A. Blickman, Blickman & Co.
"Inert-Gas-Shielded Spot Welding," by H. T. Herbst, The Linde Air Products Co.

MAINTENANCE
(South Garden)

George Nigh, Tide Water Associated Oil Co., chairman; H. R. Morrison, The Linde Air Products Co., co-chairman.
"Diversified Welding in Chemical Plant Maintenance," by Elvin M. Ratcliff, Ethyl Corp.
"Welding in Steel-Mill Maintenance," by L. P. Elly, Bethlehem Steel Co.
"What a Maintenance Department Can Do with Welding and Cutting," by Jamison Moore, Union Bag & Paper Co.

Thursday Evening—Annual Dinner
(Rose Garden)

Friday, October 29

9:30 A. M.—Simultaneous Technical Sessions

AUTOMATIC WELDING
(South Garden)

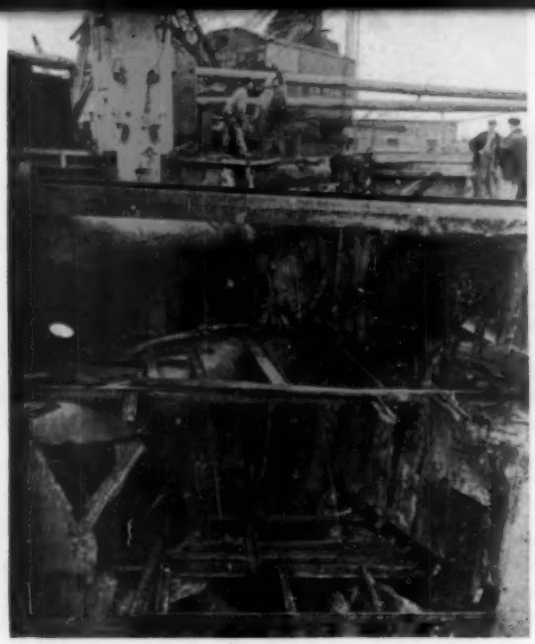
T. M. Jackson, Sun Shipbuilding & Dry Dock Co., chairman; George Johnson, The Lincoln Electric Co., co-chairman.
"Automatic Submerged-Arc Welding of 1-in. Alloy-Steel Plates," by Robert Wood, Republic Steel Corp.
"Production Tooling for Automatic Welding," by Cecil C. Peck, Cecil C. Peck Co.

MISCELLANEOUS
(Rose Garden)

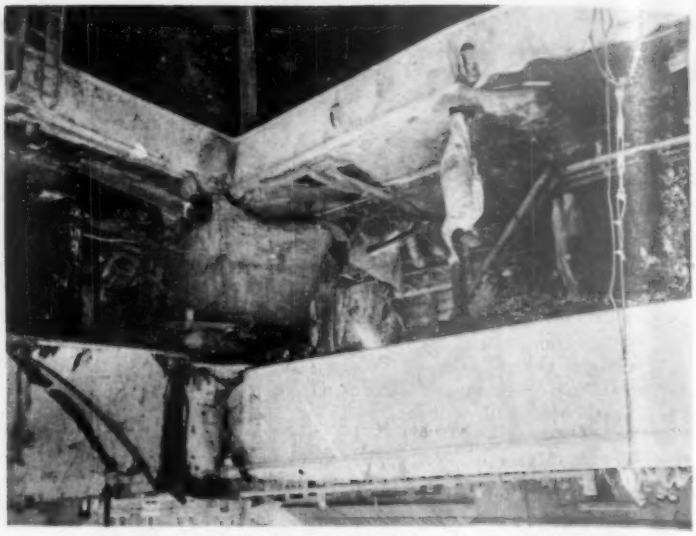
George Trefts, Farrar & Trefts Inc., chairman; A. A. Holzbaur, Sun Shipbuilding & Dry Dock Co., co-chairman.
"Ceramic and Composite Back-ups for Grooved Weld Joints," by Chester R. Austin and P. J. Rieppel, Battelle Institute.
"Fabrication of Shipping Containers, etc., Resistance and Fusion," by G. J. Green and D. H. Marlin, Dravo Corp.
"The Future Welded Design of Farm Equipment," by Ernest J. Koop, Ernest J. Koop Welding Blacksmith Shop.
"Evaluation of Effects of Residual Stresses," by T. W. Greene, The Linde Air Products Co.

HARD-FACING AND FLAME-HARDENING
(North Garden)

C. H. Jennings, Westinghouse Electric Corp., chairman; R. A. Guenzel, Southern Oxygen Co., co-chairman.
"The Economies of Hard-Facing," by J. J. Barry, and Albert Muller, Air Reduction Sales Co.
"Hard-Facing and Surfacing with the Inert-Gas-Shielded Arc Welding Process," by K. H. Koopman, Linde Air Products.
"Flame-Hardening Methods and Techniques," by J. R. Burg, The Baldwin Locomotive Works



WRECKED SHIP. Despite the enormous hole in her side, the vessel remained afloat



DAMAGED HATCH CORNERS at shelter and second decks. In this condition, the ship was towed into Falmouth harbor

THE Welds Held

Her port bow stove in by collision, the welded *American Farmer* was towed to a British dockyard. New deck and side plating were added to fill a gap measuring 34 by 26 feet

BY E. D'ACRE LACY

U. S. S. *American Farmer* was sailing peaceably in the North Atlantic when she collided with the S. S. *W. J. Riddle*. The bow of the latter ship struck the port bow of the *American Farmer* midway betwen Nos. 1 and 2 hatches and travelled a distance of some 20 ft into the *Farmer* before coming to rest at the corner of No. 2 hatch coaming. A gap some 34 ft wide by 26 ft deep was made in the ship's side plating. But the welds held. The vessel was subsequently towed into Falmouth, England, for emergency repairs.

Hole Plugged by Planking

The sketch and accompanying pictures show the extent of the damage. Her port bow temporarily reconstructed by wooden planking, the *American Farmer* was brought to Southhampton and unloaded.

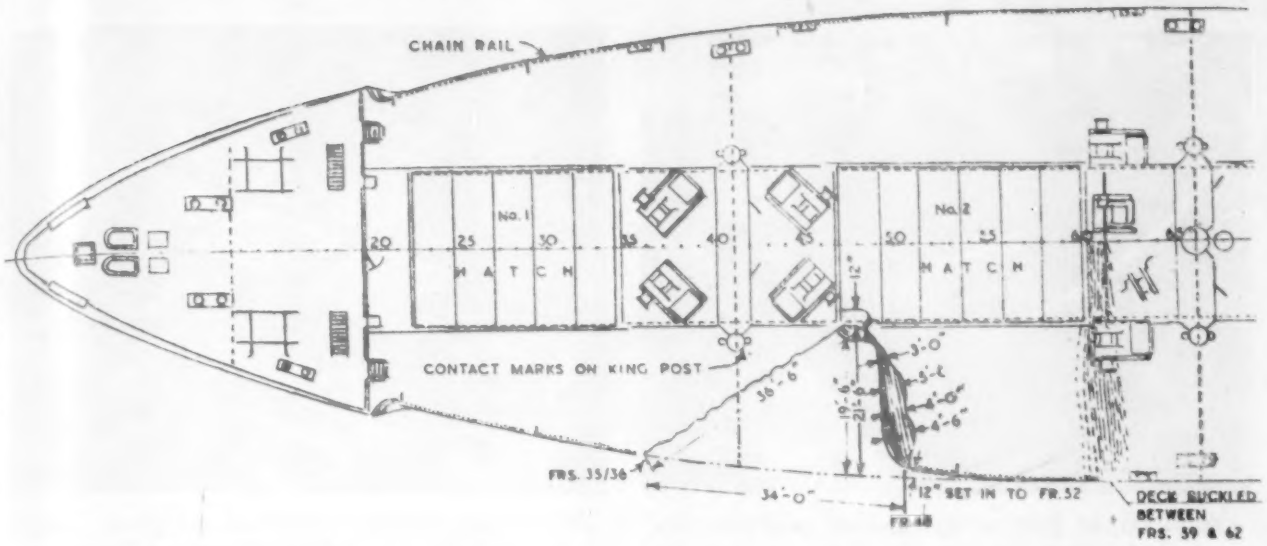
Permanent repairs were entrusted to H. M. Dockyard, Devonport, where the work was begun Oct. 12, 1946, and completed by Nov. 28.

Though the above disaster occurred two years ago, the job should be of interest to American readers as showing the methods of a British shipyard in making extensive repairs on an all-welded ship.

The hull plating of the *American Farmer* was welded in sections with athwartships circumferential welds. Accordingly, it was at first proposed to prefabricate the decks and side plating in one and two pieces by means of submerged-melt welding. This plan was not adopted on account of the considerable distance which separates welding center, where the submerged-melt machine is located, and the large docks. Moreover, the cost of transporting the prefabricated pieces by crane lighter was not acceptable. Hence all of the repairs had to be effected by means of manual welding.

Welding Done on Shipboard

All girders and beams were fabricated in the machine shops and transported to ship. Plating was delivered from the shops to the ship in the following order: No. 3 deck (closest to bottom), No. 2 deck, shelter deck, ship's side. Edges were machined in accordance with the normal welding procedure, 4 in. being allowed for shrinkage on each strake of plating for final fitting of transverse and vertical end butts.



EXTENT OF DAMAGE to the S. S. American Farmer is depicted by this plan. The S. S. W. J. Riddle penetrated the port bow nearly 20 ft, leaving a triangular hole some 34 ft wide by 26 ft deep. Three of her decks were affected

A supply of U-bolts and edge-hooks were made in shop for use in "cottering" the plates and fairing the decks.

Education for Weldors

Considerable time was spent in devising a welding specification for the ship and instructing the weldors. It was found expedient to limit the electrodes employed to two sizes only: No. 6 gauge ($^{13}/_{64}$ in.) and No. 8 ($^{11}/_{64}$ in.) A specification for every type of weld required was made. Sheets showing typical welds were printed, and a copy was given to each operator.

Specimen welds were made of every connection to show the weld beads, one layer after another. These were polished, etched and mounted on an angle frame. The exhibits were placed in a central position near the weldors for reference when a weldor was confronted with any particular connection. Finally, each operator received instruction as to the application of beads, gauge of electrode and current value. These educational measures saved time in the long run by avoiding delays in asking for instruction.

Canvas canopies were rigged above the shelter deck to keep operator and work from the rain, but, fortunately, the weather was on the whole dry (as is rarely the case in the southwest of England) throughout the period of the repairs.

DOCKSIDE at Falmouth, prior to temporary repair to ship's side

Welding the Decks

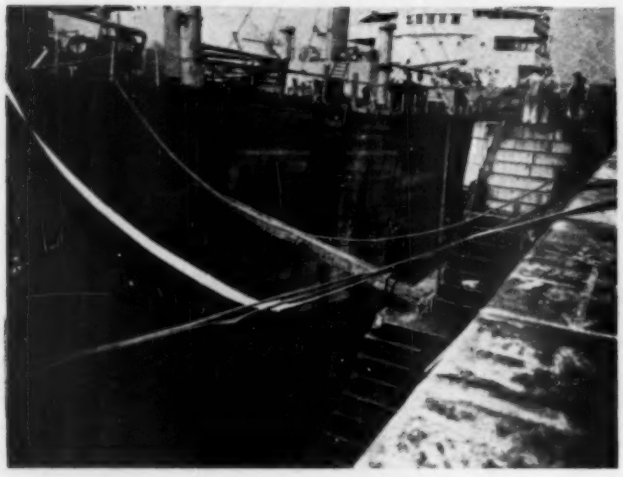
All the frames and beams were made good, and the deck plates were placed on and secured by U-bolts and wedges to the beams. The forward and after butts were left long for fitting after the other butts and seams had been welded. All welding carried out was the final welding. None of the seams or butts were tack welded, the plate being allowed to take up its own shape as welding proceeded.

The shell plating of the ship was constructed in sections, held together with continuous circumferential welds. During repair efforts were made to work to the same scheme. This was possible in the case of the decks but not in the side plating. When constructing the decks, successive strakes were completed with two weldors employed on each butt, working from the center outwards. The number of beads and size of electrodes were according to the specification already described.

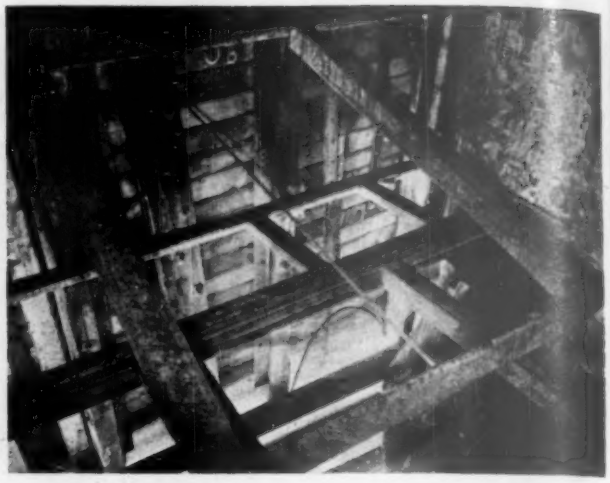
The seam nearest the ship's side was then welded after usual preparation. In order to insure a fair edge, a 6 by 6 in. angle was secured to the deck while the two edges were brought together by means of edge-hooks and wedges.

Some eight to nine weldors were employed on each seam. Each weldor had an equal length to complete, and all started together. Successive seams were welded by working towards the middle line. The after butt, the fillet weld to the hatch coaming and fillet weld to the ship's side followed one after the other, each operation requiring some six weldors. The fore butt was not continuous and varied from 5 to 12 ft lengths, four weldors being employed. Finally, all beams were welded to the deck, working from the center outwards. The U-bolts and wedges were removed when the welding, including sealing beads, had been completed.

Although the ship's side plating



COFFERDAM PATCH to damaged port bow was made at Falmouth, allowing the ship to be unloaded



INTERNAL SHORING. Timbers and planks enabled wounded ship to get to Southampton and Devonport

was placed after the deck in the order of welding, it will be appreciated that it followed very closely and often was welded at the same time as the deck plating.

It was hoped that a scheme similar to that outlined above for the decks could be employed for the side plating. Due to difficulties at the machine shops, however, an alternate plan was developed in order not to delay the work.

Each plate was secured to the frames by U-bolts, wedged tightly in position and faired by edgehooks as before. The plates were fitted in the order numbered. In each case the after butt of the strake was welded first. Where two or more plates were fitted in any one strake, the after butt was welded first, then the seam, the in-between butt, the seam and finally the forward butt. After the first three strakes had been completely welded, the frames were started from the bottom, together with the longitudinal deep girder.

In all, some six weldors were employed on the side plating. As before, the butts were welded from the center outwards while the weldors were distributed along the seams. The welding specification was closely adhered to, the upper edges of the plates being machined to 15 deg and the lower edges to 45 deg.

The various winch platforms and bed plates were welded in a similar manner to that described above.

It will be remembered that the bows of the *W. J. Riddle* had penetrated the *American Farmer* as far as the corner of the No. 2 hatch. The collision bent one of the Sampson posts out of the vertical to an appreciable degree. Luckily, bending had been localized, and it was possible to remove the bent portion by flame-cutting and to "sleeve in" a piece of fabricated tube.

The length of the new tube was 15 ft; the diameter was 2 ft 4 in. and the wall thickness 1½ in. To obtain the necessary curvature, the plate had to be passed through the rolls many times. The edge preparation was machined before rolling. Utmost care had to be taken to prevent distortion. The two half plates were held together by angles tacked to the plates, the gap between plates being adjusted by bolts through the angles. The whole was then mounted in a jig. Circular templates, made to the inside diameter of the finished tube, were used to insure the ends did not contract during welding. Any tendency in this direction could be adjusted by the bolts mentioned above.

Edges were machined for a 60-deg vee, and the seams were welded with No. 4 gauge ($^{15}/_{64}$ in.) electrodes, No. 6 gauge ($^{13}/_{64}$ in.) being used for the first bead only. To prevent the tube from bending during welding, eight weldors were employed. Four welded while the other four rested, the four welding being equally distributed on the two seams which were welded horizontally. The job was completed in 24 hours.

The new tube was fabricated in the welding shop and joined to the two old ends in the mast house. The whole mast was joined together by introducing a sleeve at each butt.

On each butt, two weldors were employed, working opposite to each other. Electrodes equivalent to AWS E-6013 were used, the first bead employing No. 8 gauge ($^{11}/_{64}$ in.) electrodes at 130 amp and laying approximately 6 in. per electrode. The next seven beads employed No. 6 gauge ($^{13}/_{64}$ in.) electrodes at 140-160 amp, laying 6 to 7 in. per electrode. The work was carried out in blocks approximately 8 to 9 in. long, the mast being turned to put the blocks in the vertical up position.

The time taken to weld was approximately two whole days; this included the time taken to cut the veed edges for the butt welds and longitudinal seam.

Distortion and Contraction

Notwithstanding the precautions taken to avoid distortion and to counter the effects of contraction during the welding of the ship's plating, a certain amount of distortion was present when the final welds were made. It was not serious and was dealt with either by building up the welds or by fitting liners. Distortion as such caused very little trouble. It occured largely because of the inexperience of the men employed on the job, sufficient allowance for contraction not being made.

The work of trimming ragged edges was commenced Oct. 12. The ship was docked in No. 9 dock Oct. 22, and her cofferdam patch was removed.

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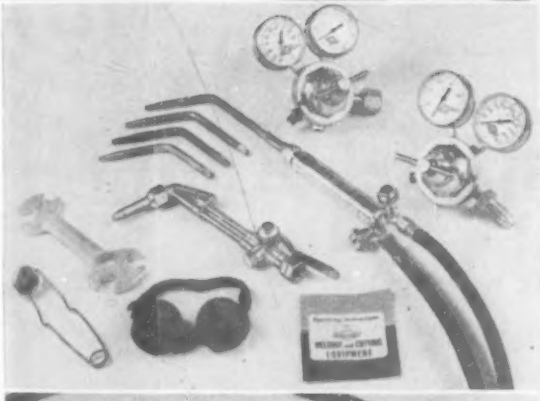

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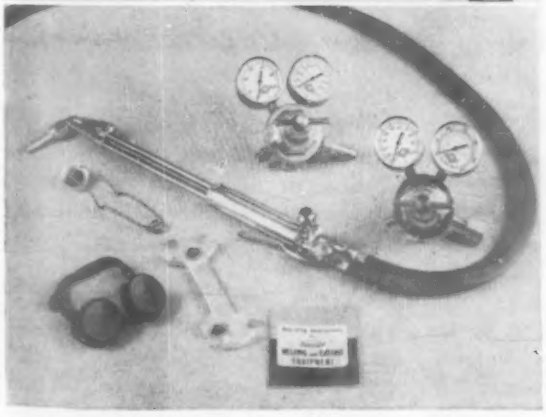

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JUST A SPRINKLE of water will cause this new-type awning to lower itself. President W. S. Elliot, of Automatic Awning Co., Daytona Beach, Fla., demonstrates

FRAMEWORK IS FABRICATED by welding aluminum aircraft tubing with a torch. The weldor is Frank Collet, vice-president and secretary of the company

Weatherwise Welded Awning

When it rains, this new awning will lower itself without attention on the part of the householder. Its framework is made of aluminum aircraft tubing

BY HENRY CHARLES SUTER

An awning that knows when it starts raining and lowers of its own accord is being produced in Daytona Beach, Fla. William S. Elliot, president and treasurer of the Automatic Awning Co., holds a patent on the device.

The awning operates by gathering the first of any rainfall into a canvas holder. When the holder fills up, the awning lowers. But the canvas holder has a drainage hole, through which the water drains out as soon as the rain stops. The reduced weight then allows the awning to rise.

The awning also has a cord like those used for Venetian blinds which will run through the window frame. By pulling the cord, a housewife can lower the awning to keep out the sun. The big curved top allows casement windows to be opened when the awning is down.

The awning framework is fabricated by gas welding aluminum aircraft tubing. Equipment has been set up to make the product in all of the 16 standard window sizes that Elliot and his associates have found. A tailor-made job for a special size could easily be produced.

The tubular framework is covered with waterproof canvas. There is little or no tension in the cloth, and its service life is estimated to be about ten years.

The Automatic Awning Co. represents a $50,000 investment. Besides President Elliot, its officers are Frank and George Collet, who serve respectively as vice-president and secretary and second vice-president and sales manager. It is hoped that the volume of business will soon justify the employment of 25 men in the factory to turn out this new type of weatherwise awning.

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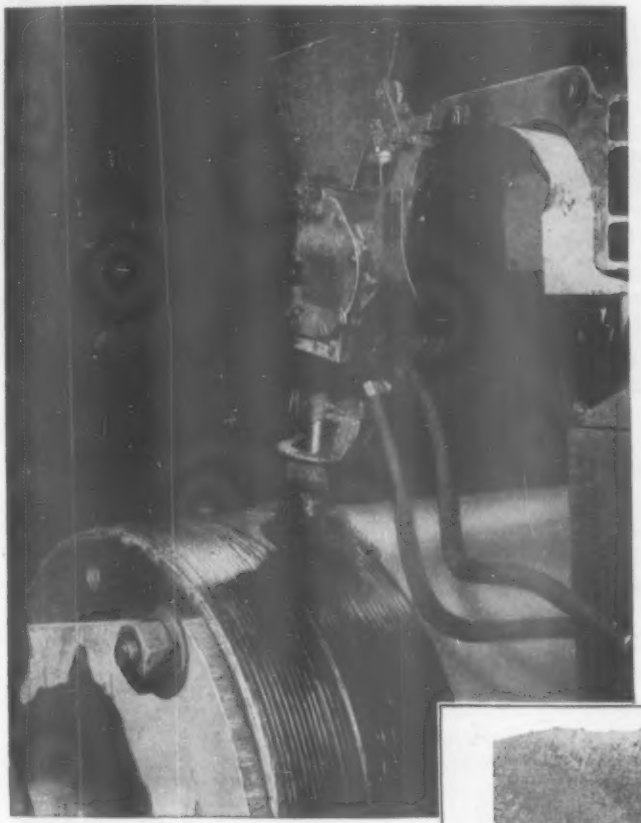

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Salute to Alloy Steel

This year's Metal Show will commemorate 75 years of progress in development and application of alloy steels. Big plans have been made for this diamond jubilee

BY WALTER MORRISON

BOTTOM POURING into molds at Lukens Steel Co.

A "Salute to Alloy Steel," in celebration of the 75th anniversary in the history of alloy steel, will be the central theme of the 30th annual National Metal Congress and Exposition. The big event will be held in Philadelphia's Commercial Museum and Convention Halls for five days beginning Monday, October 25. As in previous years, the exposition is sponsored by the American Society for Metals.

Three-Phase Program

Principal features of this diamond jubilee for alloy steel will be:

(1) A program of technical and historical papers about alloy steel.

(2) Presentation of "Distinguished Service Awards" to individuals who have made outstanding contributions to the progress and development of alloy steels.

(3) A dramatization of the part played by alloy steels in the history and development of our country. This third feature will include graphic evidence of the dependence of the American economy on alloy steel as well as the progress of alloy steels in relation to the engineering, research and technology utilized in its development.

Three important committees, each composed of men who represent both the producing and consuming industries in alloy steel, have been chosen to work out the program of the celebration. One committee, consisting of presidents of steel companies and manufacturing associations, will serve as the honorary committee.

The second committee will act on the awards to living individuals for their contributions to progress in the realm of alloy steels. This committee will consider nominations submitted to it and select the outstanding men in all branches of alloy steel.

The third committee's responsibility will be that of dramatizing the history and progress of alloy steel through a visual display of products, applications and services. This will include a dramatic display of alloy-steel products.

Committee chairmen are:

Honorary Committee: F. B. Foley, superintendent of research, Midvale Co., Nicetown, Philadelphia.

Awards Committee: J. M. Schlendorf, vice-president, Republic Steel Corp., Cleveland.

Visual and Display Committee: R. A. Wheeler, manager of publicity, International Nickel Co., Inc., New York City.

Participation Invited

The American Society for Metals is inviting readers of publications covering the metal producing and consuming fields to submit nominations of individuals they consider worthy of receiving Distinguished Service Awards. The invitation is extended in the belief that many scores of deserving scientists who have made notable contributions to the progress of alloy steels are known chiefly to fellow scientists.

To determine individuals to be submitted to the committee, let the reader of this page recall his own experiences with alloy steels in the past, compare early ignorance with present-day knowledge and put down in a letter the names of the people now living who, in his opinion, really did an outstanding job in making the transformation possible. After adding what supporting remarks or evidence are deemed appropriate, the letter should be mailed to J. M. Schlendorf, chairman, Distinguished Service Awards Committee, c/o Republic Steel Corp., Republic Building, Cleveland 1.

The Awards Committee will consider nominations of outstanding men now living in all branches of the field from raw materials to heat-treating techniques for the finished products.

Honorary Committee Members

Eleven outstanding leaders in American industry, including the presidents of eight national associations in the alloy-steel consuming field and the presidents of three of the largest steel-producing companies, have accepted appointments to serve with ASM President Francis B. Foley and Vice-President Harold K. Work on the Honorary Committee.

Association presidents are:

Aircraft, Oliver P. Echols, Aircraft Industries Association of America; automotive, George W. Mason, Automobile Manufacturers Associa-

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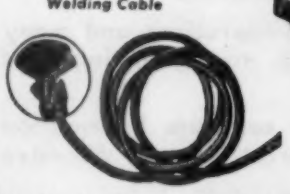

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Serving for the three major alloy steel producers are their presidents: Benjamin F. Fairless, U. S. Steel; A. B. Homer, Bethlehem Steel; C. M. White, Republic Steel.

Why Philadelphia?

Commenting on the selection of the 1948 Metal Show city, W. H. Eisenman, national secretary of ASM and managing director of the exposition, said: "Philadelphia, near the center of the nation's eastern industrial area, is readily accessible to metallurgical engineers and scientists from the northeast Atlantic seaboard and adjacent industrial centers. Too, the city's excellent facilities for handling the great displays and large number of visitors has been an important consideration."

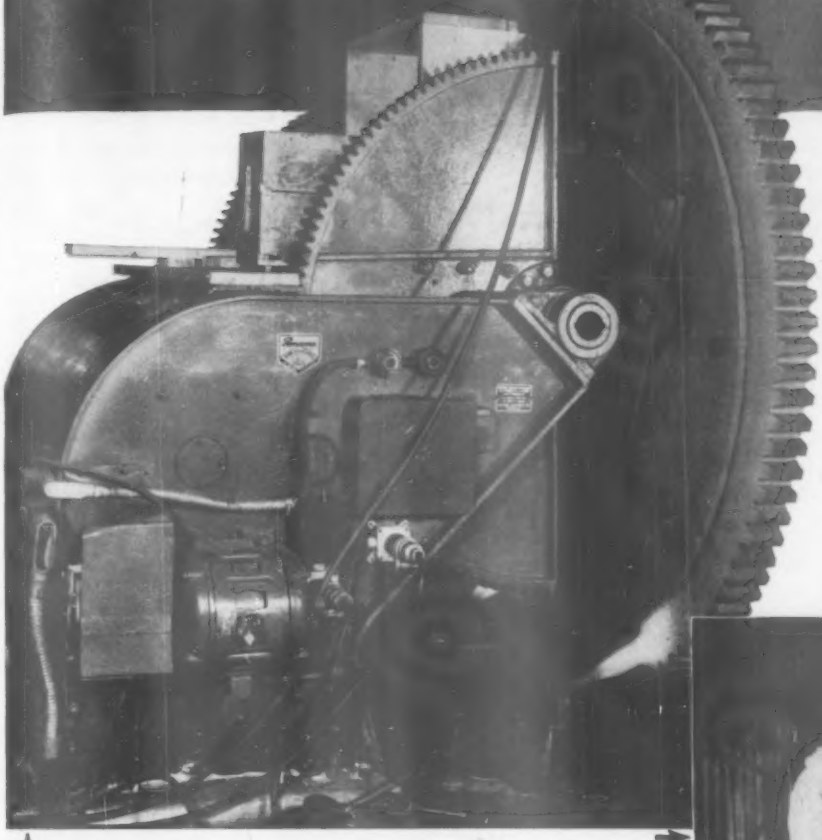
Meeting simultaneously with the American Society for Metals will be the American Welding Society (see page 60), the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers and the Society for Non-Destructive Testing (formerly the American Industrial Radium and X-Ray Society). These societies will conduct technical programs relating to the science of metals during the week of October 25.

At the present writing, some 350 exhibitors have been assigned space representing more than 85% of the total 200,000 square feet of floor space available in Philadelphia's three great exhibit areas. Anticipated attendance is estimated at approximately 30,000 persons from various industrial classifications.

The 1948 Metal Congress and Exposition marks the fourth time that the event has been held in the Quaker metropolis. Previous Philadelphia expositions were held in 1920, 1928 and 1941.

These pictures SHOW you...

This bulletin TELLS you...



Ransome 12 Ton Welding Positioner at Marion Power Shovel Co., Marion, O. Gear being welded and preheated at same time.

Ransome 2500 lb. Welding Positioner being used with automatic welding head at Wooldridge Mfg. Co., Sunnyvale, California.

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★Part Two—Synchronous Precision Timing Circ

New tubes and new circuits have effected many improvements in electronic controls for spot and seam welders

BY B. SUSSMAN
Control Engineering Division,
General Electric Co.

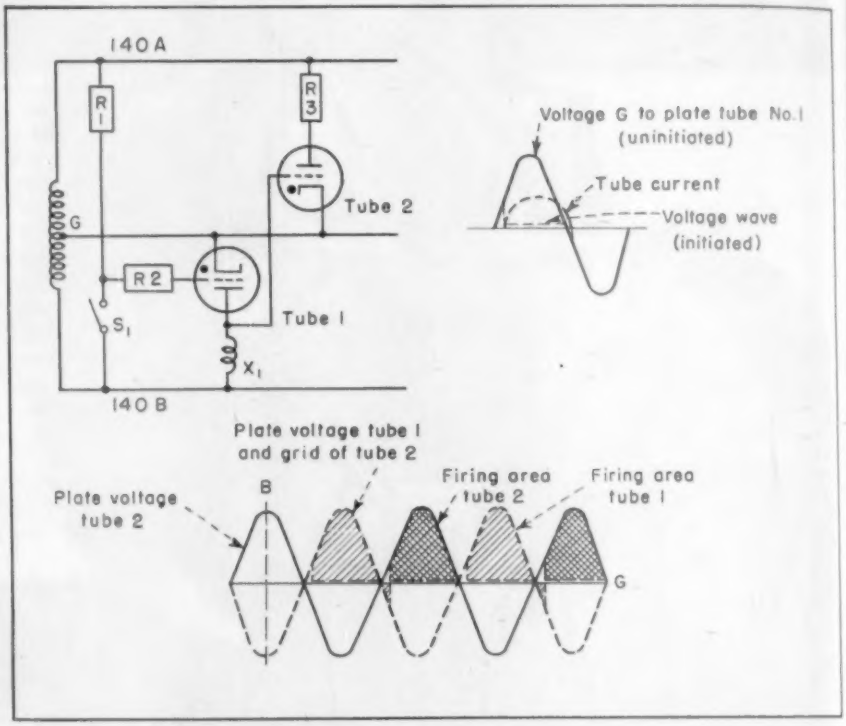
PART I of this article (THE WELDING ENGINEER, September, 1948) discussed several basic timing circuits as applied to resistance welding. These basic circuits were then put to use with the non-synchronous type of control. Additional factors must be considered before these basic circuits may be applied to the synchronous precision type of control.

Reviewing the NEMA definition of synchronous timing, we find that synchronous timing is the initiation and termination of each half cycle of welding transformer primary current so that each half cycle of such current is the same, whether in the same or succeeding welds. Synchronous precision timers must provide perfect accuracy in the 1-15 cycle range and ±1 cycle accuracy in the 16-30 cycle range.

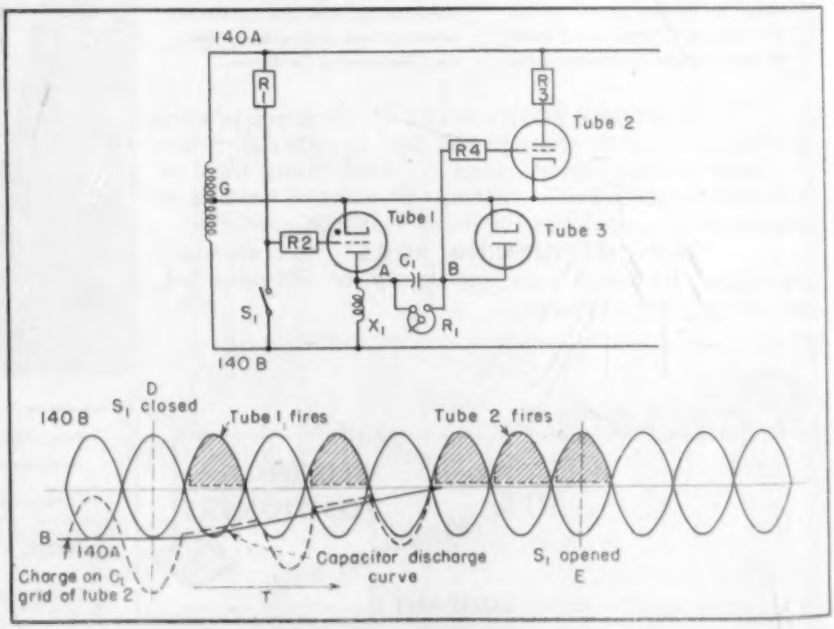
HALF CYCLES REVERSE

In welding controls, it is important that the current in the welding transformer should begin to flow at that part of the voltage wave which will give the least transients. This occurs if the ignitron power tubes are caused to fire at the power-factor angle of the load (full heat), or the current begins at that angle after the voltage goes through zero. For values less than full heat, the tubes are phased back so they fire at less than this angle.

In order that the welding transformer will not be saturated and produce transients, synchronous welding allows even numbered half cycles of weld current to flow. That is (based on an a-c sine-wave supply) the welding current is permitted to flow for ½ cycle in one direction (leading half cycle) and for the next half cycle in the opposite direction (trailing half cycle). Thus a synchronous precision timer is calibrated in terms of full cycles, and the first half cycle of welding current for each new weld will be opposite in direction to the last half cycle of the weld just preceding.



1—A-C TRAILING CIRCUIT for synchronous timers. Tubes fire at the same point on the sine wave so that each half cycle of current is the same



2—TIMING CIRCUIT using a-c trailing-circuit synchronous timers. Capacitor, rheostat and charging tube have been added to circuit of Fig. 1

R-W Controls

Circuits and Their Controls for Resistance Welding

A-C Trailing Circuit

A synchronous precision timing circuit using a-c (Fig. 1) is based upon the fact that an inductive load in the plate circuit of a thyratron tube will cause the tube to conduct after the plate supply voltage has gone negative.

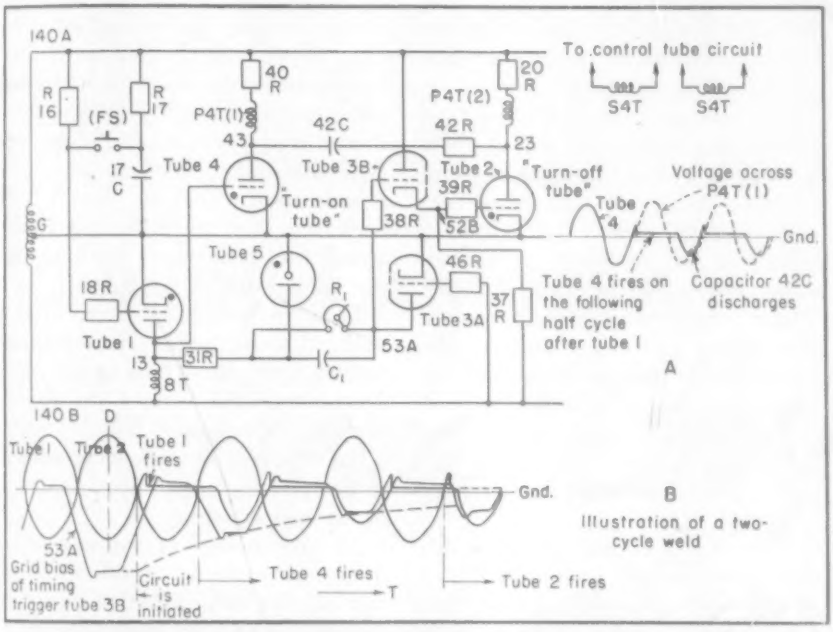
Assume that switch S_1 is closed at point B (sine wave in Fig. 1). When the anode of tube 1 becomes positive, it will fire and current will pass through reactor X_1 and tube 1 to cathode. Since the current lags the voltage, when the positive half cycle of plate voltage in tube 1 ends the current will continue to flow through the tube for a portion of the following negative half cycle of plate voltage on tube 1. Because the grid of tube 2 is connected to the anode of tube 1, and since the anode of tube 1 remains positive into the negative half cycle, the grid of tube 2 is also positive. At this time a positive voltage appears on the plate of tube 2, and it will fire. (See plate voltage wave shapes on Fig. 1.)

If switch S_1 is opened, the grid of tube 1 will be 180 deg out of phase with the plate voltage and tube 1 will not fire on the next positive half cycle of plate voltage. When tube 1 stops firing, its anode (and the grid of tube 2) will be 180 deg out of phase with the plate of tube 2, and this tube will also cease firing.

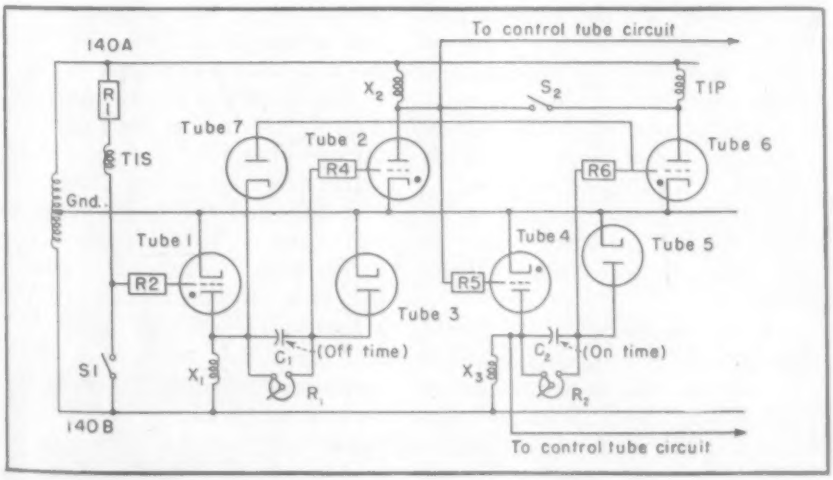
By the addition of a capacitor, a rheostat and a charging tube to this circuit, the timing circuit shown in Fig. 2 is attained. Assume that switch S_1 is open. In this case, tube 1 will not fire and capacitor C_1 will be charged to the peak value of the voltage wave between 140B and ground. The charging path is from line 140B through reactor X_1 and tube 3 to ground.

If switch S_1 is now closed, tube 1 will fire the next time its plate becomes more positive than its cathode (point D of Fig. 2).

Point A will be at the tube drop potential above ground, and point B will be negative with respect to ground. Capacitor C_1 will then start to discharge through R_1. Since the time constant is R_1C_1, the time required for the capacitor to discharge will depend upon the resistance of R_1. This time constant will increase as the resistance of R_1 increases. As capacitor C_1 discharges, point B and the grid of tube 2 will approach ground potential. When point B reaches the critical grid voltage of tube 2, it will fire. With R_1 set for a 2-cycle time delay, the voltage wave form will appear as shown in Fig. 2. Assume switch S_1 is opened at E. Tube 1 will not fire on the following positive half cycle of plate voltage, and C_1 will charge again. C_1 can never recharge while tube 1 is firing.



3—LEADING AND TRAILING half-cycle signals are furnished by this synchronous spot-welding control, which combines circuits of Figs. 1 and 2



4—SEAM-WELDING control. Two time-delay circuits are connected in series to provide two trailing timing periods for the on and off times

This basic timing circuit may be used in either a synchronous spot or seam welding control.

Spot-Welding Control

The elementary circuits of Figs. 1 and 2 have been combined in Fig. 3 to illustrate a synchronous spot-welding control which furnishes leading and trailing half-cycle signals.

When the weld-initiating switch (FS) is closed at point D (Fig. 3), the grid voltage is shifted to a 30-deg lagging position because the phase-shift network composed of 17R and 17C is now connected to the grid of tube 1. Therefore, the grid voltage of tube 1 is positive at the beginning of the positive half cycle of anode voltage. Tube 1 will always fire at the beginning of a positive half cycle or not at all.

After tube 1 has been made conductive, tube 4 will fire on the next half cycle, as shown in Fig. 1. The firing of tube 1 will also start the discharge of the timing circuit as explained in Fig. 2.

Transformer 4T has two primary and two secondary windings. The primaries are located in the anode circuits of tube 4 and tube 2 (Fig. 3). The inductive load in the anode circuit of tube 4 causes the tube to conduct into the negative half cycle of supply voltage 140A. Since tube 2 does not fire during the weld time, there is no voltage across the other primary winding of transformer 4T located in the anode circuit of tube 2. Thus the voltage at the terminals of capacitor 42C is the same as the voltage at terminals of primary winding 4T (1). When tube 4 ceases to conduct in the negative half cycle of supply voltage, capacitor 42C is left with a charge which then discharges through a circuit consisting of 4T (1), 40R, 20R, 4T (2) and 42R. This discharge of 42C prevents the voltage across primary winding 4T (1) from decaying rapidly to zero. The voltage wave appearing across the primary winding of transformer 4T (1) is shown in section A of Fig. 3. Thus tube 4 furnishes a leading half cycle signal, while capacitor 42C furnishes the trailing half cycle signal for the welder control. When tube 4 fires again during its next positive half cycle, the wave shape across primary winding 4T (1) will repeat.

When tube 1 is initiated, the voltage at point 13 will drop to GND potential and C_1 will be left with a negative charge at point 53A, which will then begin to discharge through timing rheostat R_1. R_1 can be changed to limit the discharge of C_1 from 1 to 30 cycles in 1-cycle steps.

Tube 1 conducts for about 35 deg into the negative half cycle of voltage 140B. As point 53A becomes less negative, this potential acting direction on the grid of tube 3B causes the tube to begin conducting. The conduction for tube 5 occurs for about 35 deg after its anode voltage begins its positive half cycle. As point 53A becomes less negative, tube 3B will pass more current. The grid of tube 2, point 52B, therefore becomes less negative and after the desired number of cycles the turn-off tube, tube 2, fires.

The voltages on the anodes of tubes 4 and 2 are equal and in phase so that the primary winding of transformer 4T(2) in the anode circuit of tube 2 will now have a voltage across it equal to the primary voltage in winding 4T (1). These windings are so connected that when both are energized, the flux of the windings bucks and the secondary voltage is zero.

Thus when turn-off tube 2 fires, the signal to the control tube circuit is zero (secondary windings of 4T).

The timing circuit in Fig. 3 differs from the one shown in Fig. 2 in that a voltage regulator tube, tube 5, has been added. The voltage regulator tube limits the charge on capacitor C_1 to a constant value regardless of fluctuations in the supply voltage. Also, the charge on capacitor C_1 is isolated from the grid of tube 2 by means of a vacuum tube triode 3B. Thus changes in negative grid current of thyratron tube 2 over the life of the tube will not affect the charging of capacitor C_1 This affords greater stability in the timing circuit particularly for the high resistance settings of variable resistor R_1.

At the conclusion of the weld, tubes 1, 2 and 4 will continue to fire as long as the initiating button (FS) is kept closed. When the button is released, these tubes will cease firing and timing capacitor C_1 will recharge during the next positive half cycle of point 140B. The timing circuit is then ready for another weld.

Seam-Welding Control

A synchronous precision seam-welding control using the circuits of Fig. 1 and Fig. 2 is shown in Fig. 4.

In Fig. 4, two time-delay circuits are connected in series to provide two trailing timing periods for on and off times of a seam weld.

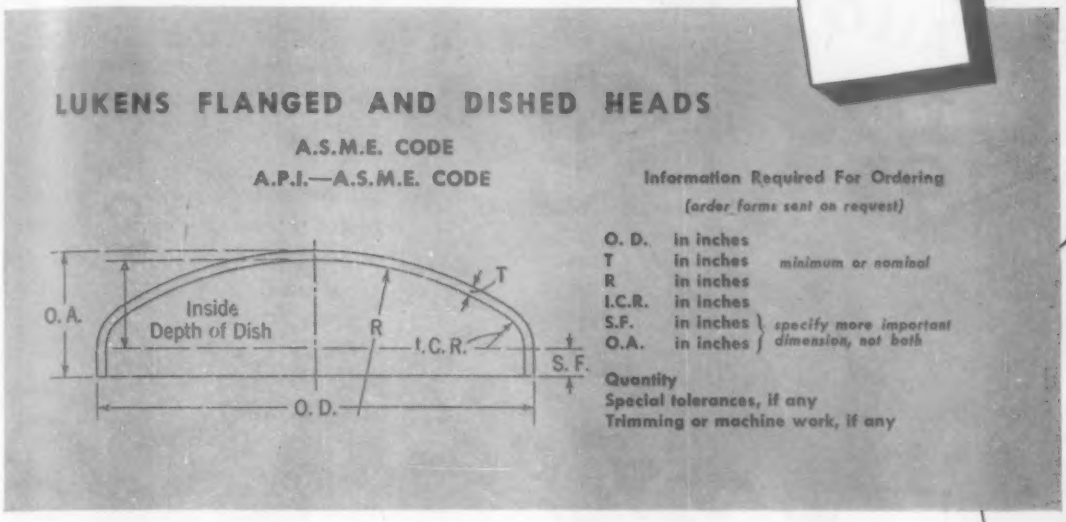
When switch S_1 is closed, tube 1 will fire and after a preset time tube 2 will fire. The trailing action of tube 2 will fire tube 4. After a preset time delay (set with R_2), tube 6 will fire, energizing the primary of transformer T1. The secondary of T1 is connected in the circuit so as to buck out the voltage affecting the grid of tube 1. Therefore, tube 1 will not fire on the next half cycle and capacitor C_1 will recharge. Tube 2 was fired again on the same half cycle that tube 6 fired, so the action repeats itself. That is, tube 4 will trail, and, after the time delay, tube 6 will fire, once again bucking out the voltage for tube 1.

Thus in switching over, tube 1 will fail to fire twice. However, the second time tube 1 fails to fire, tube 2 cannot fire, so tubes 4 and 6 cannot trail. When tube 6 fails to fire, T1 is de-energized, allowing tube 1 to fire and initiate another sequence of on and off time.

As mentioned previously, the minimum amount of off-time that can be obtained with this circuit is 2 cycles. The minimum switching time from one timing circuit to the other can be cut to 1 cycle on and 1 cycle off by adding a switch between the plates of tube 2 and tube 6, and tieing the grid of tube 6 to a diode connected as shown in Fig. 4.

The following action takes place with the off-time set for 1 cycle and the on-time set for 2 or more cycles:

Initiating the control causes tube 1 to fire, and the resistance of R_1 will allow C_1 to discharge in time to fire tube 2 on the next positive half cycle of plate voltage (140A to ground). Tube 4 will trail tube 2 and fire tube 6 when the on-time capacitor discharges. This energizes the primary of T1 and the secondary bucks out the voltage affecting the grid of tube 1. Tube 1 will not fire during the next positive half cycle and its anode will be at the potential



WHEN IS A HEAD A *Head-Shape*

Builders of boilers, tanks and pressure vessels identify the various types of heads as Flanged and Dished, Elliptical Dished, and so on through a long list of names. But thousands of Lukens Heads are bought because their shape suits them to other uses; hence, our term "Head-Shapes".

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of 140B. Since tube 2 fires again on the same half cycle that tube 6 fired, tube 4 fires during the following half-cycle. However, tube 6 will not fire for the second time because the grid of tube 6 is now tied to 140B through tube 7 and reactance X_1. Therefore, during one sequence of off and on time, tube 1 will be non-conductive for only one positive half cycle of plate voltage instead of two positive half cycles. The switch is made from the on circuit to the off circuit and back to the on in one cycle.

One cycle of on-time may be obtained by closing switch S_2. With R_1 at its minimum resistance setting, the control is initiated. Tube 1 will fire and tube 2 will trail after the off-time period. As S_2 is closed, this will energize T1, which shuts off tube 1 by virtue of the buckout voltage on the secondary of T1. By shutting off tube 1, tube 2 is kept from firing in the following half cycle, and we obtain one cycle of on-time.

Part Three of "New Electronic R-W Controls" will appear in an early issue of THE WELDING ENGINEER. *The third and final installment of Mr. Sussman's article deals with control tube and heat control circuits, firing circuit and sequence timers suitable for use with synchronous welding controls.*—THE EDITORS.

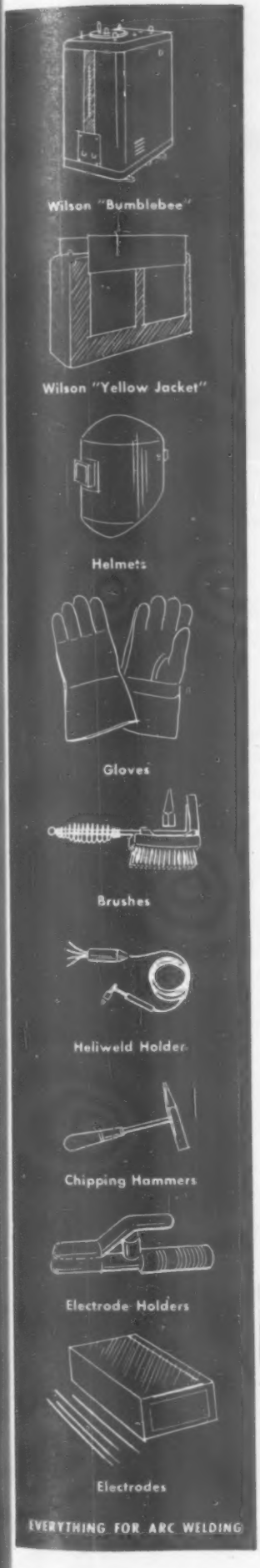
* * *

Welding and Cutting Discussed At Chicago Railroad Meeting

VARIOUS types of railroad equipment and methods for maintaining it were discussed during the three-day annual meeting of the Association of American Railroads, held at the Sherman Hotel in Chicago on Sept. 8, and 9 and 10. Welding and cutting processes were the subjects of a first-day session headed by Leland E. Grant, engineer of test, Chicago, Milwaukee, St. Paul and Pacific Railroad.

Spatterproof weldor's lamps, semi-automatic welding equipment, applications of silver soldering processes, flash welding as applied to railroad operations, restoration of worn parts and the manufacture of oxygen in railroad owned shops were discussed by various members of the committee on welding.

T. B. Jefferson, editor of THE WELDING ENGINEER gave a talk on "The Advances of Welding in Industry" which covered the importance of welding, cutting and related processes to all types of industry.



Wilson's new heavy-duty "Hornet 36A"

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The Wilson "Hornet 36A" Arc Welder is the newest member of a world famous arc welding machine family. It is a heavy-duty, light-weight machine designed to furnish smooth, steady current for every arc welding job — even under severe operating conditions.

The "36A" features simplified control of current output by means of a sturdy hand-wheel mounted on the control cabinet. Close calibration of the current dial eliminates the need for meters. Easy reversal of the polarity of the welding terminals is provided by a sturdy polarity switch.

It operates at 3600 R.P.M. and its compact design is a result of experience gained with machines with 5,000 to 10,000 R.P.M. normal operating speed. By using the same type bearings as these high speed machines, the "Hornet 36A" can be counted on for long service with an absolute minimum of maintenance.

Models in capacities of 200 amperes, 300 amperes, and 400 amperes are available. When larger current output is required, two or more "Hornet 36A" Welders may be operated in parallel.

If you desire more data on the "Hornet 36A" write for our bulletin ADW-86; address: Dept. WE - 8560, general offices, Air Reduction, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, Houston 1, Texas. On the West Coast: Air Reduction Pacific Company, San Francisco 4, California.

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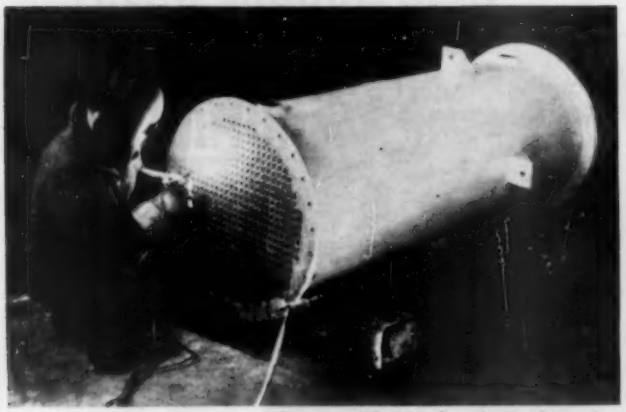


Courtesy The Linde Air Products Co.

TUBE-SHEET HEADER being welded to ¾-in. stainless-steel tubes by inert arc. Neither filler metal nor flux was necessary

Courtesy All-State Welding Alloys Co., Inc.

THREADED PLUGS used to cause trouble in dies for phonograph records, but not welded aluminum plugs. Two torches are used

Stainless-Steel Condenser

SAVINGS estimated at about 75% of the overall welding and grinding costs resulted when the manufacturer of a stainless-steel condenser switched to the inert-gas-shielded process to weld stainless-steel tubes of ¾-in. OD by ⅛-in. wall thickness into the ¾-in. tube sheet.

Argon gas was used to shield the tungsten electrode and weld area, eliminating the need for flux. Flux, it might be noted, is not required in the argon-shielded welding of any of the common commercial metals and alloys, with the single exception of copper. The smooth, neat welds required only superficial grinding: cost was but $8 as compared to the $50 grinding cost required with former welding procedures.

No filler metal was necessary, and the welds could be started and stopped easily without development of crater cracks. Welds of good corrosion resistance were obtained with a low degree of porosity.

* * *

Plugging Aluminum Dies

PHONOGRAPH records are made by pressing the wax platters against a heated master die made of solid 75-ST aluminum 1¼-in. thick. This aluminum die offers a perfect miniature example of radiant heating and cooling. A series of radial holes are drilled in the solid metal, all crossed at right angles by one central hole. Ends of the radiating holes are plugged, and live steam is introduced through the center hole, heating the entire die uniformly to 450 F. Later, water is passed through the same channels for quenching.

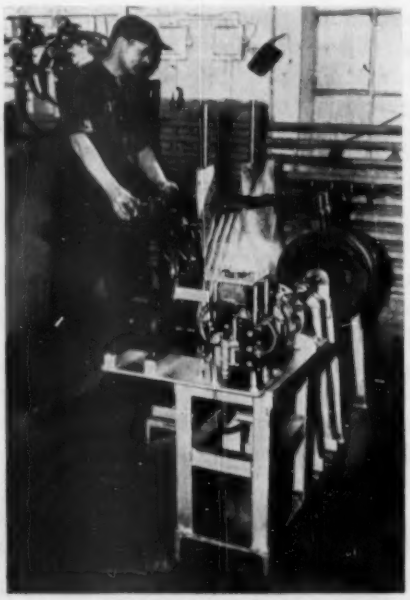
Formerly, it was the custom to seal the holes with threaded brass plugs, and these caused plenty of trouble. The difficulties could be eliminated, it was decided, by doing away with threading and sealing the plugs permanently. The plugs are now made of 24-ST aluminum, like the master disc, and recessed to a depth of about half an inch. The hole is then completely filled in with sheet-aluminum brazing rod applied by torch heat.

Accompanying picture shows the welding procedure. Preheating of the die is done with an oxyacetylene torch, and the actual welding is done with an oxyhydrogen torch at a temperature of 1,000 F.

* * *

Crane Life Increased

POWER cranes and shovels manufactured by the Thew Shovel Co., Lorain, O., are moving mechanical testimonials to the oxyacetylene process of flame-hardening. Since its introduction to the process some years ago, the company has expanded the application of flame-hardening to include such important units of a TL-20 crane as gears, jaw clutches, wearing strips, the roller path, rollers, chain sprockets and beveled gears.



Courtesy Air Reduction Sales Co.

TRIPLE TORCH set-up with special tips flame-hardens surface of crane sheave

Thew has designed a triple torch set-up with special tips for the simultaneous hardening of three sheaves. The process permits increased resistance on the throat of the sheave, where the wear is obviously greater, thereby increasing the work life of the sheave. By treating only the desired area, hardness is localized where needed, leaving the balance of the sheave ductile enough for proper machining.

Generally, to obtain any appreciable degree of hardening, the material treated must be of such chemical composition as to respond readily to heating and quenching. For carbon steels, the carbon content must be at least 0.35%. Cast and malleable irons of suitable composition may also be satisfactorily flame-hardened.

* * *

Vest-Pocket Razor

R. G. AREY had an idea for a dry-shave razor—a tiny ⅛-in.-wide blade which would flip back and forth in a slot as the razor was rolled across the face. Neither shaving cream nor electric motor would be needed, and the razor could be carried around in a vest-pocket for removal of "five o'clock shadow."

The T-shaped blade was to be made by welding a strip of hardened and tempered steel to a strip of mild steel. Ward Machine Co., Inc., Brockton, Mass., liked Arey's design ideas but didn't know how the two dissimilar steels were to be welded together. A field engineer of the Progressive Welder Co., Detroit, was called in for consultation.

The two pieces are now welded together automatically on a production basis by a miniature roll spot welder. This does a blade in under 1/10 second—a rate of 1,440 spot welds a minute.

Courtesy The Lincoln Electric Co.

OUT FOR A RIDE! This youthful model shows how easy it is to manage a new "pony-size" roller for jobs like golf courses, private lawns and driveways

Small Welded Roller

CUTTING down a road roller from elephant to pony size while retaining the rugged strength of the larger roller is the accomplishment of the Steel Equipment Co., Cleveland. The new roller is believed to be the first powered model ever built for tasks such as rolling lawns, driveways, golf courses, ball fields and other sites where a full-sized road roller would be impracticable.

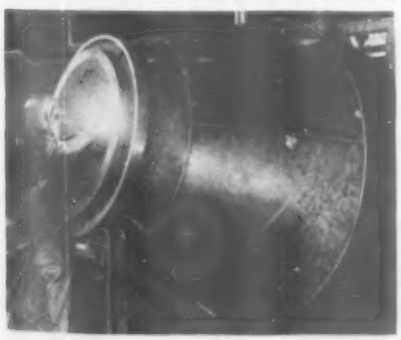
Of all-welded steel construction and driven by a 6-hp gasoline motor, the new machine weighs approximately one ton, has a 3.5-ft wheelbase and a 42-in. body width. Its weight can be increased when desired by adding a 600-lb concrete block in the machine bed.

* * *

Mixer Production Speeded

JAEGER Machine Co., Columbus, O., is said to be the world's largest manufacturer of concrete mixers. Jaeger has a new 8-cu-yd mixer measuring 86 in. in diameter by 27 in. in height. This big job is constructed of four plates of ¼-in. carbon steel, sheared and formed in the Jaeger plant and welded in a special fixture. For added strength, the entire discharge end (see picture) is double-butt-welded.

On a 4½-cu-yd truck-mounted mixer, Jaeger has reduced production time by 50% by using welded fabrication.



Courtesy General Electric Co.

DISCHARGE END of an 8-cu-yd concrete mixer welded at Jaeger Machine Co.

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Both goggles are available with Noviweld lenses, shades 3, 4, 5, 6, or 8 . . . or with Noviweld-Didymium lenses shades 3, 4, 5, or 6 for screening out yellow sodium flare. Easily replaceable cover lenses protect against pitting or scratching of filter lenses. Both goggles also have easily adjustable one-piece rubber headbands that resist oil, water, grease and perspiration. Your nearest AO Safety Representative can supply you with these eye protection favorites.

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RED BRASS CALLS FOR CARBON ARC WELDING

Courtesy of The Lincoln Electric Company, makers of the "Electronic Tornado" automatic welder shown.

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Adaptation of automatic shielded carbon arc welding to red brass tanks is producing highly satisfactory results for a leading manufacturer of electric drinking water coolers. Minimized vaporization and oxidation reduces rejections for pinholes 75 per cent — bursting strength is doubled through deeper penetration and stronger welds — economy is the end result.

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On the Subject of Monkey Wrenches

"THE California Division of Architecture was rather scathingly criticized in a recent editorial appearing in THE WELDING ENGINEER (May, 1948) for its action in requiring magnetic-particle inspection on structural welds on school buildings for which it is responsible. The editorial, entitled "Monkey Wrenches," refers to the cost of such 'needless' inspection as tending to rule welding out of the structural field from a competitive standpoint.

"We are in no position nor is it our intention to argue the broad question of what inspection should or should not be used on structural welds in general. That some inspection may be justified on some structural welds, however, seems difficult to deny, and it might be of interest to the readers of THE WELDING ENGINEER to be informed of what actually has been done to date in the matter of inspection of welds on school buildings in California.

"The authorities in California are conscious of their responsibility to provide, insofar as possible, public buildings which will have the greatest probability of withstanding the severe stresses put upon them during an earthquake—a contingency unfortunately not remote in that state. In adopting welding as a means of construction of steel-frame buildings, they felt some more-than-usual care in the way of inspection might well be worth while to insure that serious cracks or other defects did not occur at locations where they might lead to failure during the shaking and swaying the buildings would sustain during an earthquake.

"Requirements were therefore tentatively written into the specifications for certain school buildings calling for a limited amount of magnetic-particle inspection in order to determine whether such inspection could prove useful in insuring sound welds at economically feasible cost. Other methods of inspection were not ruled out unless they ruled themselves out on the basis of cost. Currently, the requirements call for magnetic-particle inspection on welds carrying a vertical load and designed for 100% joint efficiency. Welds carrying a vertical load and designed for a joint efficiency of more than 60% but less than 100% are subject to the same inspection but on a quality-control basis, usually 10% of the total number of welds. This program is flexible and subject to change as conditions warrant.

"Inspections were started in early 1947, and to date certain welds in 202 roof trusses and beams for nine public schools have been inspected at plants of five steel fabricators. With a very few exceptions, no inspections of this type have been carried out on welds made in the field. The average cost per beam or truss has been somewhat under $5, though the actual cost for any one job necessarily varies with the number of members available for inspection at one time and the distance the inspector has to travel to reach the fabricator's plant. By no means all welds are inspected, the

architect indicating on the contractor's blueprints those welds in which the presence of cracks would be considered highly objectionable. The designated welds were inspected by the magnetic-particle method, using rapid techniques designed to locate only actual cracks and gross defects.

"In the course of the inspection of the 202 beams and trusses, 59 defects were marked and subsequently chipped out and repaired. Of these, by far the majority were small surface cracks, 1 in. long or less. A few longer than an inch were located. The worst crack found was in the lower chord of a truss and extended 2 in. into the weld and for 4½ in. into the structural steel angle itself. This crack was not observed under visual inspection.

"We believe the engineers of the California Division of Architecture are to be commended for the sound and careful approach to an inspection problem which, under the circumstances imposed upon them by local conditions, stood in the way of the use of welding for this structural job. Far from hindering the development of welding in this area, the tentatively adopted methods have made possible its use in this instance.

"We heartily agree that no needless inspections should be required nor carried out, even if the cost is not excessive. We also feel that an open-minded approach to a discussion of what may or may not be of value in the way of in spections of structural welds under any given set of conditions will lead to a sound policy."

C. E. BETZ (signed)
Executive Vice-President
Magnaflux Corp., Chicago 31

* * *

News Bureau Opened by G-E X-Ray Corp.

CREATION of a news bureau to render increased service to newspaper and magazine editors and writers has been announced by W. D. Crelley, merchandising manager of the General Electric X-Ray Corp., Milwaukee.

Operation of the bureau is under the direction of David Goodman, also editor of the house organ *General Electric X-Ray News*. He is assisted by C. W. Fagel.

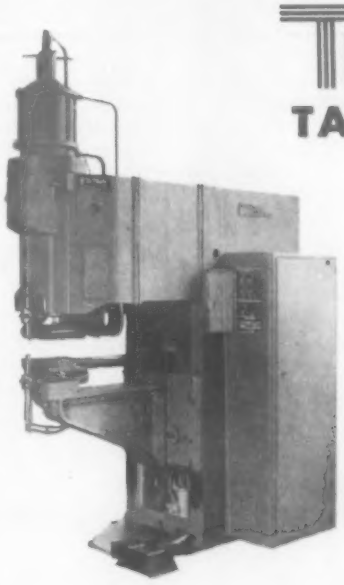
* * *

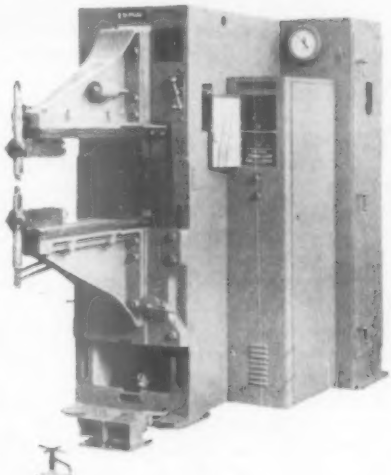
Resistance Welding Orders Jump in Second Quarter

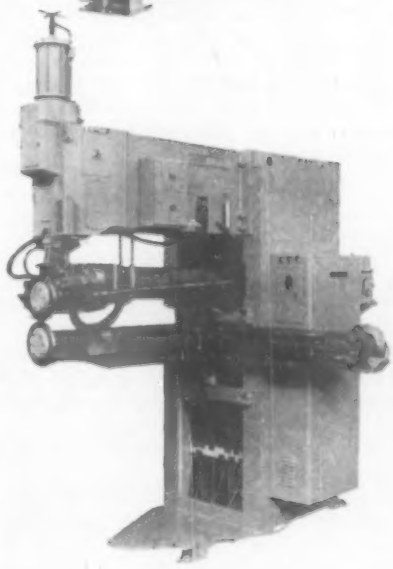
NEW resistance-welding equipment orders received by manufacturers during the second quarter of 1948 exceeded first quarter orders by 13% and were over 22% ahead of shipments for all 1938, according to the Resistance Welders Manufacturers Association.

July shipments were a half million dollars higher than June, and four times the shipments of July, 1939, best year prior to the war.

95% POWER FACTOR
BALANCED THREE PHASE
WITH
Tri-Phase
TAYLOR-WINFIELD
WELDERS
(RESISTANCE)







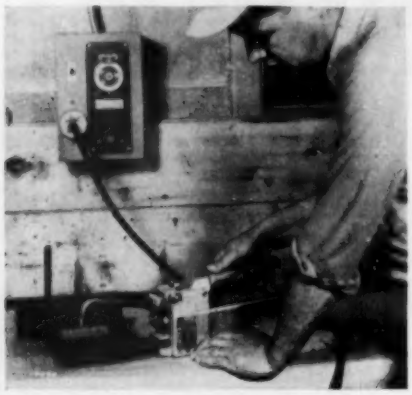
Six Highly Desirable Features . . . (1) greatly reduced power demand; (2) three phase balanced power load; (3) desirable high power factor (95%); (4) improved weldability; (5) deeper throat depths with essentially no increase in power demand; (6) with Tri-Phase, you can weld low carbon steel, stainless steel, aluminum alloys, magnesium, Monel, Inconel, brass alloys, and other materials on same welder.

Tri-Phase can be had in spot, projection, seam, or upset-butt welders. Ask for Tri-Phase Bulletin 10-813 just off the press.

THE TAYLOR-WINFIELD CORPORATION
WARREN, OHIO, U.S.A.

TAYLOR-WINFIELD
RESISTANCE WELDERS

New Products to Use



ADJUSTABLE timer control for portable spot welder has range of 3 to 120 cycles

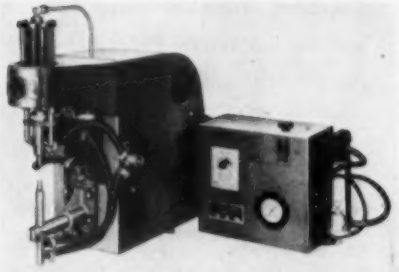
Timer Control

MILLER ELECTRIC MFG. Co., Appleton, Wis., has a new timer control for use with its Model MSW portable spot welder. The control is said to provide more efficiency, more uniform spots, increased tip life and render the welder suitable for production work.

Timer is a NEMA Type 1-A timer for single-impulse spot welding. It is adjustable from 3 to 120 cycles and operates on 60-cycle current at either 110 or 220 volts. A numbered indicator disc, geared to the selective cycle control, indicates the cycles in use. A switch enables quick turn-on and turn-off. Timer may be mounted on the wall or a bench.

Any Miller MSW portable spot welder can be adapted for use with this timer.

* * *



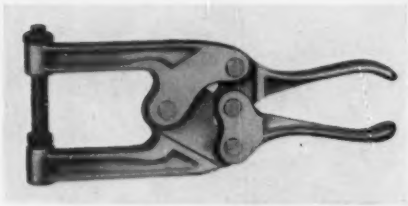
BENCH-TYPE spot welder with attachments for operation at 220 volt, 60 cycles

Bench Welder

FOR joining small metal parts, WELDEX INC., 7339 Mc Donald Ave., has a 7½-kva bench-type spot welder, Model 752-PB. It is built to handle light gauge nonferrous or ferrous metals. Standard equipment includes: a built-in four-step transformer, tap-changing switch, single-acting air cylinder, magnetic contactor and electronic timer. Regularly furnished for 220-volt, 60-cycle operation, the welder is also available in 380 or 440 volts on special order.

Additional features are: double-acting air cylinder, two-stage foot switch, platform-type lower horn arrangements for mounting special welding fixtures of varying heights, tube-type contactors and stored-energy control panel. Standard throat depth is 4½ in.

* * *



SQUARE THROAT increases capacity of pliers. Available with copper spindles

Vise Pliers

TWO improved "Knu-Vise" pliers, offering enlarged throat capacity and higher applied pressure, have just been developed by LAPEER MFG. Co., Lapeer, Mich. The new design has a square-throat opening, which permits thicker work to be inserted to a greater depth. Length is no greater.

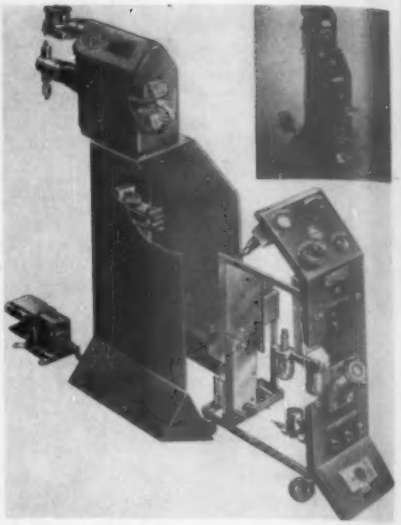
Increased spindle diameter of ⅜ in. gives greater stiffness and a more secure grip. For weldors' use, the pliers can be furnished with copper spindles which prevent adhesion of spatter. Model P-1200 with throat capacity of 1 $\frac{5}{32}$ in. by 2¼ in. provides 1,200 lb clamping pressure. Model P-1800 with throat capacity of 1$\frac{5}{32}$ by 1¼ in. provides 1,800 lb clamping pressure. Both pliers have the toggle action locking grip which can be instantly applied and released.

* * *

Low-Hydrogen Electrode

LOW-HYDROGEN type electrodes designed to prevent underbead cracking in weld deposits have been developed by the Air Reduction Sales Co. The new electrode, known as Airco No. 394, operates with either a-c or d-c and is said to give welds of 100,000 psi tensile strength.

Applications are anticipated in the fabrication of hardenable steels that are susceptible to underbead cracking when ordinary electrodes are used without preheat. AIR REDUCTION SALES CO., 60 E. 42nd St., New York City.



EFFICIENCY, economy claimed for new general purpose 60 cycle a-c spot welder

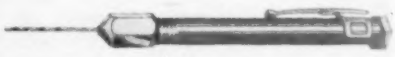
Spot Welder

LOW impedance and high power factor are claimed for a general purpose spot welder, the "Fusionette," produced by the PRIME-WELD CORP., 2842 West Grand Blvd., Detroit 2, Mich.

This spot welder is said to approach the performance of a capacity discharge type welder but at a lower cost. Design features permit the time lag between closing of the contactor and build-up of full secondary current to be reduced to a minimum.

Stock from .004 to .100 in., aluminum up to .040 in. without special preparation and stainless steel are handled by the welder. Multiple layer and shunt welds can also be made. Mechanical features include: quick disconnects on air, water and electric wiring; pedestal control unit and panel mounted on a roller carriage which can be withdrawn for inspection and servicing; lower arm adjustable 4 in. to vary throat height. Floor space required is 19 in. wide by 39 in. deep. The "Fusionette" operates on 110/220 volts a-c, 60 cycle.

* * *



CARBON-STEEL drills in sizes 45-80 fit pocket-size welding tip drill kit

Tip Cleaner Kit

APPROXIMATELY the size of an automatic pencil, a new tip drill kit is also equipped with a pocket clip. The end is a tempered steel chuck holding drill sizes 45-80. The handle holds 24 drills of different sizes. Twelve drills, the even numbered sizes from 52-74 inclusive, are supplied with the kit and others are available as extras. Manufacturer states that with the carbon-steel drills, almost any welding tip can be cleaned and reconditioned in several minutes. J. M. RAGLE INDUSTRIES, 4029 Indiana Ave., Kansas City, Mo.

Now the Marsh line will include

Witt OXYGEN and WELDING Gauges

On September 30, the Witt Gauge Division of National Pressure Cooker Company was acquired by Jas. P. Marsh Corporation. As a result, the broad line of Marsh instruments will be still further broadened to include oxygen and welding gauges.

The Witt oxygen and welding gauges will be manufactured in the main Marsh plant by the "Witt Gauge Division of Jas. P. Marsh Corporation."

To users of oxygen gauges this is a significant development. It means that the respected quality of the Witt line will be further heightened by Marsh experience and the unmatched facilities of the new Marsh plant.

WITT GAUGE DIVISION OF

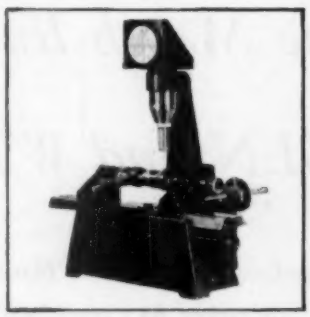
JAS. P. MARSH CORPORATION

DEPT. 29, SKOKIE, ILLINOIS

Light Projector Increases Thread Grinding Production

Production of thread grinding machines can now be increased through the use of a light projecting device called the Thread Pick-up Projector. The thread profile appears in a viewing screen, magnified 20 times, thereby permitting accurate visual adjustments.

In operation the Thread Pick-up Projector is placed alongside the thread grinding machine. A Dalzen Thread Grinder, Model No. 1, is shown above. While the machine is grinding the thread, the operator, using the Light Pick-up Projector, adjusts a "dog" on the next piece to be ground. When the "dog" and piece are then placed in the thread grinder the thread profile is automatically in location and ready for grinding immediately.



Thread Pick-up Projector

Even the most inexperienced personnel can "pick up the thread" using this instrument after only a few minutes demonstration. Grinding is also done more accurately and the viewer permits measurements of reliefs, notches, etc. to .0005 inch.

Efficiency of production can also be increased through the use of chewing gum. The act of chewing helps relieve nervous tension and seems to make the work go easier and faster. For these reasons, Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.

Complete details may be obtained from
Acme Scientific Company
1457 West Randolph, Chicago 7, Illinois

AC-76

DOUBLE SWIVEL on Weldor's vise allows positioning for downhand welding

Weldor's Vise

DOUBLE-SWIVEL arrangement is a useful feature on the recently developed Desmond "Simplex" weldor's vise. Vise is available in three models with 5, 6 and 7 in. jaw openings. With the swivel arrangement, the weldor does not have to bend or crouch since the work can be turned for downhand welding. The vise can also be used as a regular swivel-base machinist's vise. A solid steel slide is provided for added strength. DESMOND-STEPHAN MFG. CO., Urbana, O.

* * *

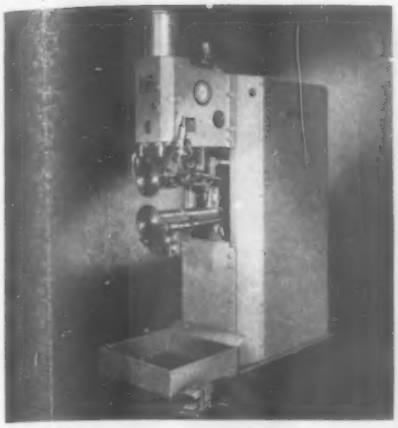
CARTRIDGE-HEATED soldering iron said to maintain heat for 10 minutes

Soldering Iron

REQUIRING no electric current or external heat, a new soldering iron known as the "Quik-Shot" utilizes a chemical cartridge to obtain the proper temperature. The iron will heat to working temperature in five seconds, it is claimed, and maintain heat for 10 minutes.

The cartridge is placed in the copper tip of the iron before work is begun. When the spring rod at the back of the handle is pulled and released, it strikes the cartridge primer to set off the heating action.

Useful for outdoor work where electric current is not easily available, this iron comes equipped with five cartridges. Several sizes of tips are available. THE KEMODE MFG. CO., 2 West 46th St., New York 19.



ANTI-FRICTION rollers guide and align electrodes on seam welder to follow slight deviations in material thickness

Seam Welder

PROGRESSIVE WELDER Co., 3050 E. Outer Drive, Detroit 12, is producing a new line of roller-head seam welders for light, medium and heavy duty. The head is guided and aligned by four sets of anti-friction rollers so that the welding wheels, two disc electrodes, will follow small deviations in material thickness.

Rollers are matched in pairs, adjustably preloaded and ride on V-guides to guide the head the full length of its vertical travel. Other features include: quick change over from circular to longitudinal welding; larger throat clearance; transformer close to the welding arms to reduce current loss; triple independent water-cooling systems; optional straddle or outboard-mounted wheel locations.

Control units may be mounted on the right side of the machine. Left side is a hinged door panel in which is mounted all electric machine controls. All piping is outside the column for simpler installation and maintenance. Motor drive unit is removable for servicing.

* * *

Stainless Electrodes

TWO new electrodes, "McKay 29-9 and 29-9 Mo" were developed for welding heat-resistant steels such as AISI type 312 (29-9). These meet fabricators' specifications and may be used in all positions. Test results of the as-deposited weld metal show that it is free of inclusions and porosity, has a tensile strength of approximately 111,000 psi and 35% elongation in 2 in.

Recommended applications include welding of steam and gas turbine blades, high temperature and high-pressure pump parts and hard-facing worn parts. Casting of the electrode can be modified to make alloy additions to the weld metal; *i. e.*, the "29-9 Mo" electrode. Another possible variation is the increase or decrease of carbon to attain specific mechanical properties. This electrode is available in the following sizes with corresponding settings: 1/8 in., 95-120 amp; 5/32 in., 145-170 amp; and 3/16 in., 190-215 amp. McKAY Co., 1005 Liberty Ave., Pittsburgh 22.

Here's an actual case history that speaks for itself:

"On a typical high temperature job where ordinary brazing carbon electrodes were changed hourly, Stackpole electrodes lasted all day."

Of course there must be a reason for outstanding performance like this—these Stackpole tips were processed with the famous Stackpole "F" Anti-Oxidation treatment. Three to four times longer life on the average job is an extremely conservative estimate of the savings involved.

Stackpole Brazing and Welding tips are saving money on dozens of difficult jobs. They can save money for you, too! WRITE FOR SAMPLES. State shape and size required. Mention company connection.

MAKE THIS TEST ON
WELDING
CARBONS!

When operations requiring high current values for the size of the electrode are encountered, try the new Stackpole COPPER COATED rods! As compared with uncoated types, these electrodes increase current carrying capacity, provide better contact between holder and electrode, reduce the amount of tapering required, last longer, and produce better welds. Write for samples today. Test them in your actual production operations.

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Also Manufacturers of Dualarc Engine Driven DC Welders — Nu-Arc AC Transformer Welders — Smith-Dalan Induction Heaters.

SUPERSONIC reflectoscope, Type SR05, is smaller, lighter than previous models

Supersonic Tester

PRODUCTION of a small lightweight "Supersonic Reflectoscope," type SR05, has been announced by Sperry Products. It is used for non-destructive testing of metals and for testing of welds (see page 33, THE WELDING ENGINEER, June, 1948). Elimination of waste air space and a redesign of circuits make for decreased weight and bulk. The tester is approximately 14 by 16 by 23 in. and is carried by the handles on the case.

Sensitivity remains the same, but external controls have been reduced to five. The increased portability makes the device valuable for field testing of welds in tanks, pipe and various plant structures. SPERRY PRODUCTS, INC., 1505 Willow Ave., Hoboken, N. J.

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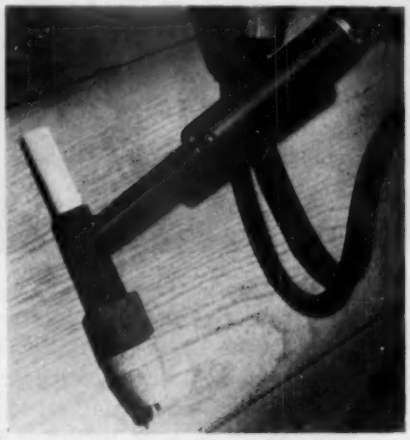

ALL-PLASTIC 300-amp water-cooled holder developed for inert-arc welding

Inert-Arc Holder

AIRCO manual "Heliweld" is a heavy-duty water-cooled holder having a capacity of 300 amp and suited for production and general-purpose work. Exterior of the holder is all-plastic, providing insulation against both the welding current and the high-frequency current required for arc-starting and stabilization. Weight is 28 oz. The built-in water circulating system extends almost to the point where the electrode is gripped. AIR REDUCTION SALES CO., 60 E. 42nd St., New York City 17.

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for Steel Users

UNITED STATES STEEL SUPPLY COMPANY
USS STEELS
SERVICE

Prompt shipments of Welding Rod for electric arc welding can now be made from our stocks:

- MILD STEEL ELECTRODES
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In addition, we can take care of your requirements for Welding Machines, Havens Protected "C" Clamps and Protect-O-Metal (used to simplify removal of welding spatter). Telephone, wire or write our warehouse nearest you.

UNITED STATES STEEL SUPPLY COMPANY

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LOS ANGELES (54)	LAfayette 0102
MILWAUKEE (1)	Mitchell 5-7500
NEWARK (1)	Bigelow 3-5920
	REctor 2-6560—BErgen 3-1614
PITTSBURGH (12)	Allegheny 4200
ST. LOUIS (3)	LUcas 0440
SAN FRANCISCO (1)	MArket 1-4988
	ENterprise 1-0017
TWIN CITY-ST. PAUL (4)	NEstor 7311

UNITED STATES STEEL

HAND SHIELD, is one-piece seamless fibre, weighs 11 oz. without welding lens

Hand Shield

LIGHTWEIGHT seamless welding hand shield is announced by AMERICAN OPTICAL CO., Southbridge, Mass., for tack-welding and setup work or operations where a helmet isn't practicable. The small compact shield is made of one-piece fibre. Lens holder is of steel, insulated and rivetless. The fibre handle is 5½ in. long and securely riveted to the body. Without lens, the shield weighs 11 oz. It is available with standard "Noviweld" or "Filterweld" glass plates.

* * *

FAST MARKING of rods, wire is claimed for bearing-operated marker

Marking Unit

MARKING metal rods at the speed of production is now claimed possible with a new machine developed by the ACROMARK CO., 5-7 Morrell St., Elizabeth N. J. Marking Machine No. 14 consists of a ball-bearing marking roll that carries engraved steel segment dies held in position by a face plate. Screw holes are elongated to permit changing of segment dies by loosening of the screws and a turn of the face plate.

This marking roll is mounted on an angle-type base which can in turn be bolted to a bench or stand. At one end of the base is a pivoted arm on the end of which is a grooved pulley. Pulley is interchangeable for different size grooves to suit various diameters. The machine may be used to mark steel, iron, brass, lead or plastic rods, tubing and wire.

precision regulation

TWO-STAGE
REGOLATOR

The precision performance of the two-stage RegOlator is especially desirable for piped distribution systems and other applications where large volumes of high pressure gases must be controlled accurately.

Two-Stage RegOlator Gives You Plus Performance!

Constant delivery pressure regardless of drop in pressure at the inlet... Patented design incorporates nozzle-type first stage counterbalanced by stem-type second stage... Triple action cartridge filter eliminates troubles usually caused by rust, dust or dirt.

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Pioneer and Leader in the Design and Manufacture of Precision Equipment for Using and Controlling High Pressure Gases

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WHIP
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IN 6 HOURS
Now Eutectic Research offers a vastly improved EutecTrode 24 for AC or DC (reverse or straight). Fully machinable thru the weld and weld zone. EutecTrode 24 will not cross-check. Application is mild steel type (no preheat). Non-fuming (clear arc at all times). Appearance of finished weld has mild steel electrode finish. FRIGIDARC coated to make a smoother, sounder FRIGIDWELD that matches base metal in strength and appearance.
There is a EUTECTIC LOW HEAT ALLOY to serve every industrial welding need. Order now for all your needs. Send for information and free field consultation service.
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Low Temperature
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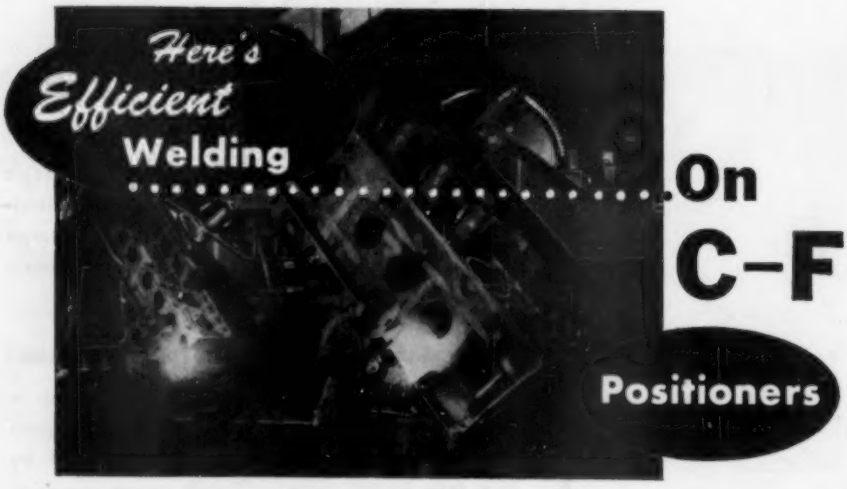
WELDRODS
"The Welding Miracle of the Century!"
EUTECTIC WELDING ALLOYS CORP.
40 Worth Street, New York 13, N. Y.



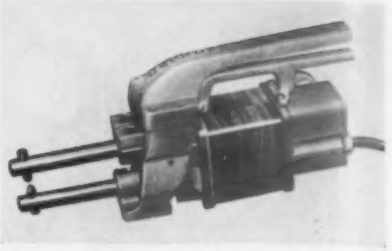
When heavy, unwieldy weldments like these diesel crank cases can be quickly swung into any position so that every weld is made **downhand**—that's efficient welding!

Weldors spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

Write for Bulletin WP24—an illustrated circular detailing the Specific advantages of C-F Positioners.

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds



ONE-HAND spot welder handles 18-26 gauge metals, uses 110 or 220 volt a-c

Portable Spot Welder

ALCASCO FOUNDRY & MFG. CO., 14823 Loomis St., Harvey, Ill., is marketing a one-hand portable spot welder which can handle ferrous alloys, including galvanized iron, in thicknesses from 18 to 26 gauge.

In operation, the upper tip of the welding tongs is rested on the metal to be welded and the handle is squeezed to bring the jaws together. Trigger is then pulled to make the weld. The welder is available in tong lengths of from 6 to 18 in. for either 110 or 220 volt operation. Offset tips are optional. Weight is about 22 lb. Ten feet of cable comes with the welder.

* * *

COMBINATION welder controller has timer and magnetic contactor in one unit

Welder Controller

COMBINING weld timer and contactor in a single unit, the new Square D Class 8992 Type BBG-1 controller provides complete electrical control for a small foot-operated or motor-operated resistance welder. The single enclosure contains a NEMA 1-A pneumatic weld timer, a size 1W, 100-amp high-speed magnetic contactor and a control transformer.

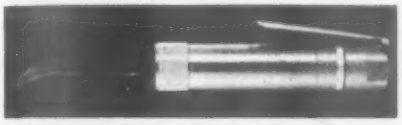
For operator safety, the initiating switch and control circuits operate on a 110 volt circuit isolated from the power supply. Timer is mounted on a swing-out panel, which has adjusting dial on the front and all energized parts in the rear. All controllers are designed to permit either common or separate control supply connections. A dual primary control transformer may be connected for 110, 220 or 440 volts 60 cycles, or for 380 volts 50 cycles. SQUARE D CO., 4041 N. Richards St. Milwaukee 12.

HIGH-FREQUENCY stabilizer for inert-arc welders made in 300, 500 amp sizes

High-Frequency Stabilizers

HIGH-frequency stabilizers designed for use with a-c or d-c welders in inert-arc welding are being made in 300-amp and 500-amp sizes by HOBART BROTHERS Co., Troy, O. They are also useful with the twin-carbon arc torch, in vertical and overhead welding and in other applications involving low currents. The stabilizer increases the electrical impulses from 120 per second to 4,000,000. A control is provided to adjust the frequency.

* * *



METERING ACTION of throttle on air hammer gives low pressure for light jobs

Pneumatic Hammer

LIGHT pressure on the lever throttle of the S-1 scaling hammer meters sufficient air to dislodge small deposits of weld flux or spatter. Heavier pressure gives full power for bigger deposits. Exhaust air cleans chips and scale. This tool is designed for one-hand operation. Chisel is easily removed by thumb pressure on the retainer. Chisels are furnished in blanks, flats and spoon shapes, and a full line of star drills is available in sizes from 3/16 to 1/4 in. ROTOR TOOL Co., 17325 Euclid Ave., Cleveland 12.

* * *

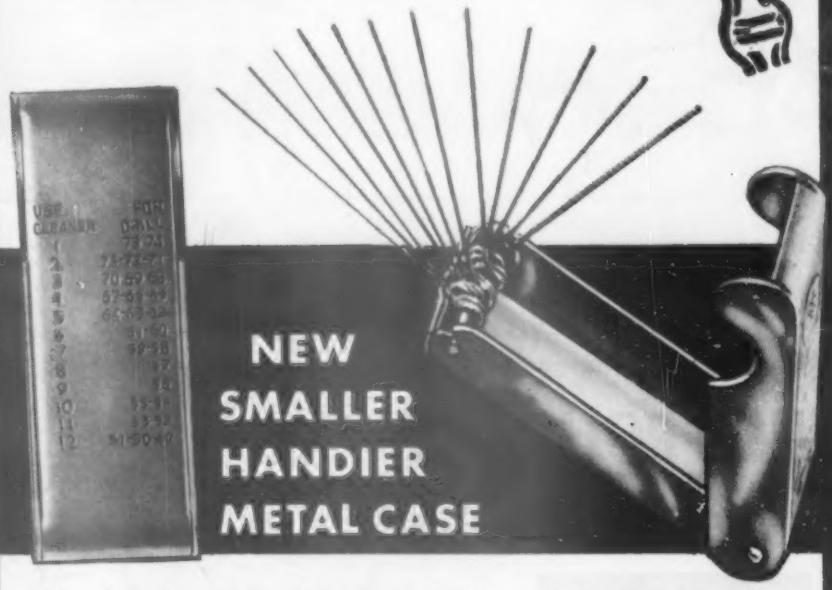
Lens Coating

THE WALLACE OPTICAL CO., INC., 12344 East Jefferson Ave., Detroit 14, announces a new method of coating industrial safety lenses, called "Tuf-Cote." This coating is said to make the surface of the lens impervious to welding spatter and emery pitting.

Cover plates on welding helmets, when treated by this process, will need little replacement. "Tuf-Cote" is a patented solution applied to the outside surface of lenses of all types, including weldor's filter plates. It was perfected by opticians and meets optical requirements. Industrial safety lenses, plano or prescription ground, can be sent to the Wallace Optical Co., for coating or glasses can be ordered directly from them.

THERMO LEADS AGAIN!
WITH A NEW
ADVANCED DESIGN
of the Welder's Favorite
THERMO Tip Cleaners

The new re-designed Thermo Tip Cleaner (enlarged drawing at right) is made with wider spaces between ridges, enabling carbon to be carried out of the tip without enlarging or damaging the orifice, no matter how badly clogged it may be. This means a clean, true flame ALL the time and no waste of welding tips through damage by ordinary type cleaners.



NEW
SMALLER
HANDIER
METAL CASE

No guessing size of cleaner to use—drill sizes stamped on case. New, scientific design of cleaner proved best by laboratory tests. New, light, compact metal case protects cleaners from damage in tool case or pocket.

Greatest advance in cleaner design in history of acetylene welding. Welders who have tried Thermos will use no other.

Ask your welding supply dealer for the NEW Thermo Tip Cleaners.

THERMACOTE COMPANY
Newark Chicago Los Angeles Portland

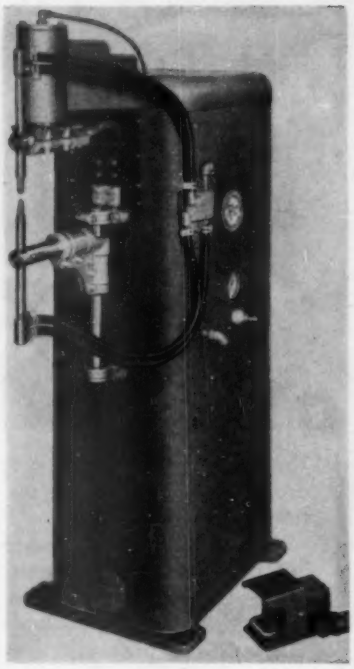
Banner 15 KVA SPOT WELDER

- High Speed—Quality Production
- Simple—Rugged Construction
- Easy Maintenance

Typical of the many advantages of Banner Spot Welders is the unique head construction of the unit illustrated. A rugged aluminum-bronze piston, with long bearing surface, is equipped with 3 cast iron piston rings which reduce friction to a minimum.

Special steel guide through the cylinder wall and piston prevents side play of the head—thus assuring clear uniform welds.

This air-operated, 15 K V A press type Spot Welder which is floor mounted, has many other distinctive features illustrated in booklet, "Banner Welders and Brazers."



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11% to 13½% Manganese-Nickel Steel

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. . . and they get tougher (work-hardens) under impact and abrasion. Saves you time and money because Manganal lasts longer. Puts your equipment back to work faster because it's easier to work with. Can be rolled or bent, hot or cold. Thousands of users specify nothing else but Manganal after the first test. Why don't you also make the test and be convinced?

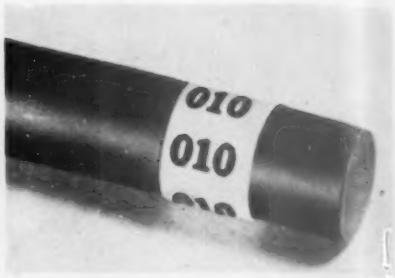
NAME OF NEAREST DISTRIBUTOR ON REQUEST

FREE! Our Booklet "The Welding of 11% to 14% Manganese Steel."

STULZ-SICKLES CO.

Sole Producers

91 N.J. Railroad Avenue NEWARK 5, N.J.



REMOVABLE code wire markers identify type and grade of alloy on raw metals

Metal Markers

USE of E-Z code wire markers as a means of identifying raw metals has been developed by Kollsman Instrument Division of The Square D Co. The markers are self-adhesive strips that adhere to any metal surface. They are printed in fade-proof ink and are said to be unaffected by temperature, humidity and handling. Each marker bears the code for the basic alloy and specific grade.

Markers may be peeled off the metal. Hence it is possible to remove the marking strip from a portion of metal about to be machined and then reapply it to the remaining piece before it is returned to storage. Markers are provided on a card equipped with a tab; when tab is pulled it delivers a strip ready for application without moistening. WESTERN LITHOGRAPH Co., 600 E. Second St., Los Angeles.

* * *

Stainless-Steel Electrodes

TWENTY-SEVEN new stainless steel electrodes cover the complete range of types and diameters required for all commercial grades of chromium-nickel and straight-chromium steels. These electrodes are available with either a combination titania-lime type coating suitable for welding with a-c or d-c reverse polarity or a straight lime-type coating for welding with d-c reverse polarity only. Each conforms to the new AWS designation A 5.4-46T, ASTM, designation A 298-46T tentative specifications for chromium and chromium-nickel steel welding electrodes.

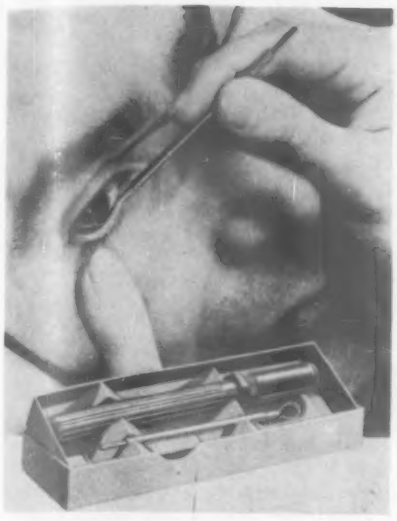
Suitable for welding in all positions up to 3/16 in., these electrodes are said to be characterized by smooth bead finish with relatively flat contour, smooth action with extremely low spatter loss, correct bead formation and easy slag cleaning. WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30.

* * *

Grinding Belt

RESINALL METALITE," a new heat-resistant dry grinding belt has just been developed by BEHR-MANNING CORP., Troy, N. Y., a division of the Norton Co., Worcester, Mass.

Thermo-setting resin adhesives instead of conventional glue-bond adhesives are used in the new belts. Production increases of four to one over the old type belts are claimed by the manufacturer. For high-heat generating operations, number of pieces per man-hour and number of pieces per belt are said to increase.



EYE SWEEP has magnetic end and flexible loop for removing particles from eyes

First Aid to Eyes

WHERE workers are exposed to flying metallic fragments, filings, or other foreign metal substances subject to magnetic attraction, a new first-aid instrument, called an eye sweep, has proved useful. It has one end fitted with a magnet for removing metal fragments and the other with a flexible loop for removing cinders, dust and other particles. Sterilization of the instrument will not diminish the magnetic qualities nor affect the loop, states manufacturer. A hard rubber carrying case is provided with each sweep. GENERAL SCIENTIFIC EQUIPMENT CO., 2700 W. Huntingdon St., Philadelphia 32.

* * *

Hard-facing Electrodes

ABRASION resistance and efficient cutting qualities are claimed for two new tubular electrodes and welding rods called "Tube Tungsite" and "Tube Tungrod." Both rods contain tungsten-carbide particles and are offered for both oxy-acetylene and arc applications.

The particles of tungsten-carbide are deposited in the weld metal, the heaviest at the line of fusion with the parent metal, the smaller remaining in suspension. "Tungsite" particles come in sizes ranging from 5-8 to 30-40 mesh. These rods and electrodes are useful for rotary drill bits, bean knives, power shovel teeth, dredge cutters, scraper blades, scarifier teeth, etc.

"Tungrod" contains smaller particles, 40-125 mesh, and is bare for gas welding and coated for arc welding. Gas-welding applications for Tungrod are coal cutter bits, pug-mill knives, core cutters, plow shares, etc. Tungrod arc-welding electrodes are used for grader blades, screw conveyors, etc.

Tungsite nuggets and inserts, which are particles of much larger sizes, are available in pure tungsten carbide or in tungsten-cobalt carbide. AMERICAN MANGANESE STEEL DIV., AMERICAN BRAKE SHOE CO., Chicago Heights, Ill.

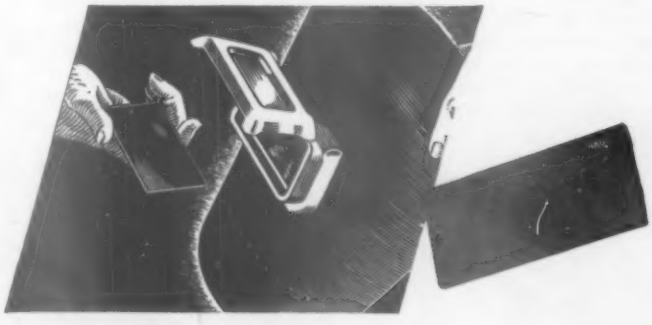
under "Arc lights" ... think of WILLSON

Style No. 130

A LITTLE MONEY GOES A LONG WAY . . . to give dependable protection to face and eyes in this ruggedly built, low cost helmet. Willson-Weld glass in non-corrosive metal holder.

Style No. 605

GIVE WELDERS' EYES A LIFT . . . Flip-front on this one piece helmet allows quick, easy inspection and is convenient for working in close quarters. Willson-Weld Glass in hinged portion.



WW THE MARK OF MEASURED PROTECTION . . . The Willson-Weld* trade-mark on welding glass is your assurance of accurate grading for density of shade and thickness to meet or exceed government specifications.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest Willson distributor or write us direct.

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1102 WASHINGTON STREET, READING, PA., U. S. A.

News of the Industry

Courtesy Nelson Stud Welding Division Morton Gregory Corp.

CARRIAGE FIXTURE speeds stud welding on large petroleum dewaxing unit cylinders being manufactured at General American Transportation Corp. More than 200,000 studs, ⅝ in. diameter and 1 in. long were placed by this method. Up to four studs per minute were welded in an automatically controlled cycle initiated by the pull of the welding gun trigger. The gun carriage indexes along the fixture track to affix studs on 3¼-in. centers

Steel Billets Produced By Continuous Casting

REPUBLIC Steel Corp., Cleveland, and Babcock & Wilcox Tube Co., Beaver Falls, Pa., have developed a simple method for casting of steel from liquid phase to semifinished shape. Important advantage of this process, according to this source, is the by-passing of massive and expensive apparatus in conventional steel-making such as ingot molds, soaking pits, and blooming mills. In continuous casting the molten metal passes directly to semifinished billets that are ready for secondary mills. Results have indicated that ovals of special proportions are the most practicable cross-section to continuously cast, because they go readily into a rolling mill to be shaped into rounds and flats.

Recently, continuously cast slabs have been rolled into strip which has been converted to arc-welded boiler tubes meeting all physical requirements of B & W boiler tubes.

The process is carried on in a 75 ft tower. Steel from electric furnaces is poured into an inductively heated holding and pouring ladle at the top. From the holding ladle the steel pours into a tundish or funnel, which strains out the slag. From the tundish, the steel flows into the mold. An operator watches the surface of the steel in the mold by a mirror arrangement to see that it is clean. Proper cooling of the mold is essential. Below the mold, the casting passes through an insulated chamber which arrests and controls the speed of further cooling. Under the chamber is the withdrawal mechanism. The casting then passes an oxyacetylene torch which travels down the billet to cut it to specified length, which may be as much as 35 ft.

Continuous casting is said to allow faster cooling, resulting in a fine and uniform crystalline structure with little segregation. Less opportunity is afforded dirt and other foreign material to enter the castings and, in general, the surface will be free of checking and scabs and the interior free of entrapped slag, B & W officials say.

* * *

Welded Steel Barge Carries Sulphuric Acid

A WELDED steel barge designed for transportation of concentrated sulphuric acid along the Gulf of Mexico was launched recently at the Neville Island shipyard of Dravo Corp., Pittsburgh.

The 175-ft *Gloria* was built for Consolidated Chemical Industries, Inc., Houston, Tex., to carry acid to industries along the waterway route covering Texas, Louisiana, Alabama, Mississippi, and Florida.

The acid is contained in two cylindrical steel tanks each 8½ ft in diameter and 135 ft long running parallel the length of the hold. Cradles of 2-in. thick hardwood blocks support the tanks which are sealed under pressure during voyages. Since sulphuric acid becomes very corrosive when diluted with water, the barge was decked over with steel to make the hold watertight.

* * *

Field Service Shops Set Up by Lincoln

LINCOLN ELECTRIC Co., Cleveland, is now authorizing service and repair organizations to be field service shops for Lincoln equipment.

Each field service shop sends men to the Cleveland plant for approximately two weeks of training in the repair and service of the company's welders. The shops will also handle parts for all types of Lincoln welders as well as parts for Hercules, Wisconsin and Continental engines.

* * *

Federal Machine & Welder Buys Warren City Plant

FEDERAL Machine and Welder Co., Warren, O., has arranged to purchase the plant and facilities of the Warren City Mfg. Co., also of Warren, from the U. S. Navy.

Federal has been operating this plant for the building of all-welded steel presses since January, 1946. The original plant was expanded in 1942 and equipped by the Navy at a cost of $7,000,000. The plant is now about ¼ mile long and has a floor area of 225,000 sq ft. It is said to be one of the country's most modern and complete shops for welded fabrication.

* * *

Linde to Build North Dakota Plant

CONSTRUCTION of an oxygen distributing station and acetylene producing plant at Fargo, N. D., by the Linde Air Products Co., New York City, has been announced. Plans also include a warehouse for the distribution of Union Carbide and Carbon Corp. carbide.

Site for the plan consists of five acres at the corner of Seventh Avenue North and 22nd Street North. A spur track of the Great Northern Railway will serve the plant. It is expected that the distributing station and acetylene producing plant will be in operation early in 1949.

* * *

Turco Builds Plant at McCook, Ill.

TURCO Products, Inc., manufacturers of industrial cleaning compounds, will build a new plant at McCook, Ill. to supplement present plants at Chicago, Los Angeles, and Houston.

Weld Pipe Headers for Natural Gas Line

PRODUCTION of 130 welded discharge headers was accomplished by the Midwest Piping & Supply Co., St. Louis, as one of the essential steps in the completion of the new 26-in. pipe line from Amarillo, Tex., to Chicago. The line, being built by the Natural Gas Pipe Line Co. of America, will enable an extra 147,000,000 cu ft of natural gas to be brought to the Chicago area this winter.

The 18-in.-diameter discharge headers return the gas to the pipe line after it leaves the compressors at the pumping stations. Pipe sections are 12 to 15 ft long with walls ⅜ in. thick. The headers were given full-furnace treatment to stress relieve them, and all nozzle and butt welds were inspected by gamma rays. Nozzle welds were reinforced by welding saddles.

* * *

Pressurized Smelting Tested Successfully

PRESSURIZED smelting, which observers say may increase the output of iron and steel by nearly 50%, has been tested successfully in two converted blast furnaces at Cleveland and Youngstown, O., according to a report by *Scientific American*.

In principle, the furnace is partially sealed by a valve system which prevents the hot gases from escaping into the air. The imprisoned gases cause pressure to be built up inside the furnace, with a resulting higher temperature to speed the chemical processes of smelting.

Blast furnace pressurization is the invention of Julian M. Avery, New York chemical engineer and vice-president of the Hodges Research and Development Corp.

* * *

Nelson Stud Welding Adds Engineering Service

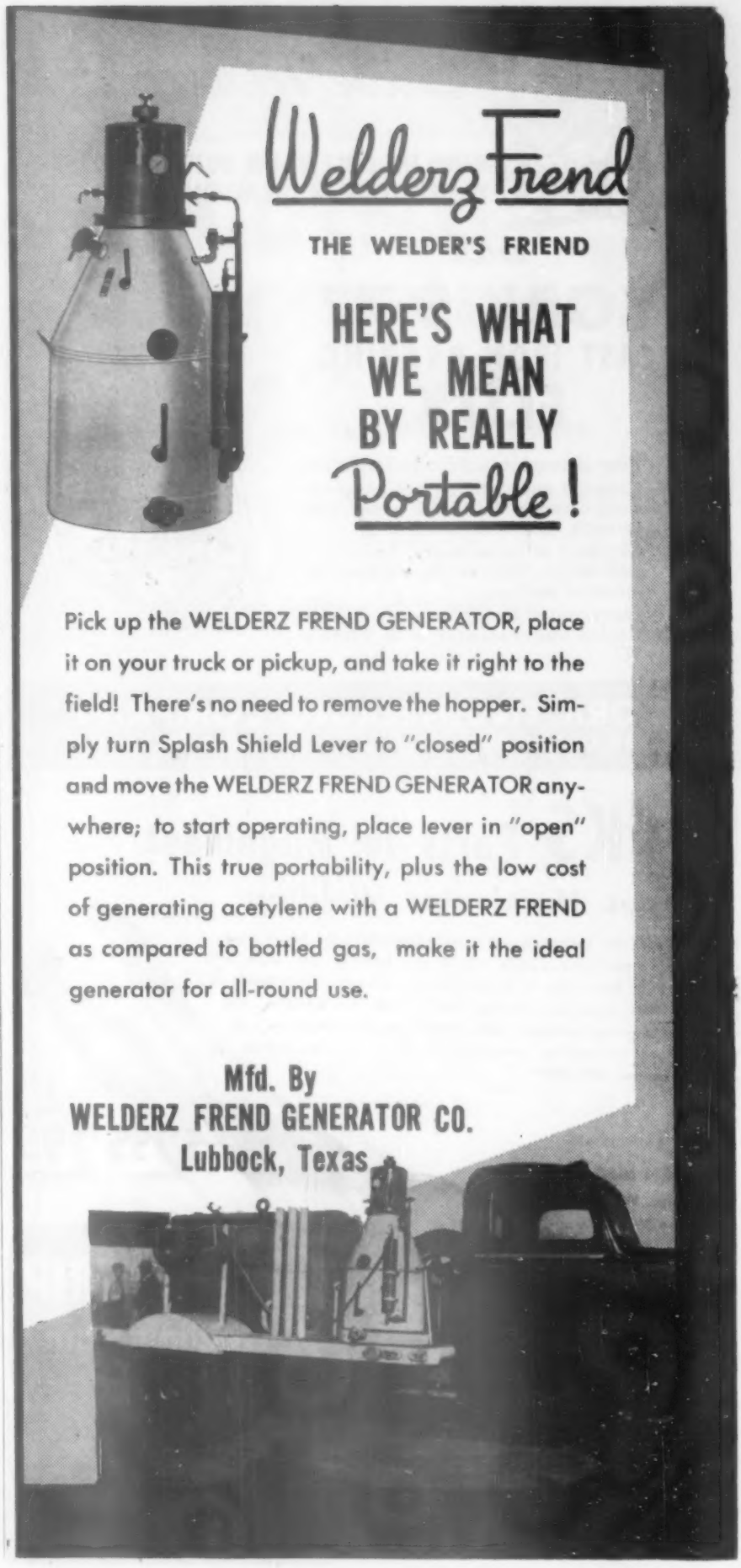
A CUSTOMER engineering service department, under the direction of Robert C. Singleton, has been established by the Nelson Stud Welding Division of Morton Gregory Corp. at its Lorain, O., headquarters.

Engineers and metallurgists in this department will devote their entire attention to the development of new stud-welded fasteners and production units to aid manufacturing and construction firms.

* * *

Welding Equipment Firm Opens at Ashtabula, O.

WELD-CUT, INC., a subsidiary of Welding & Cutting Supply Co. of Cleveland, O., has opened its offices in Ashtabula O., for the distribution of welding supplies and equipment. Manuel M. Powar is president of both firms. Paul Cholfin will manage the Ashtabula plant.


Welderz Frend
THE WELDER'S FRIEND
HERE'S WHAT WE MEAN BY REALLY Portable!
Pick up the WELDERZ FREND GENERATOR, place it on your truck or pickup, and take it right to the field! There's no need to remove the hopper. Simply turn Splash Shield Lever to "closed" position and move the WELDERZ FREND GENERATOR anywhere; to start operating, place lever in "open" position. This true portability, plus the low cost of generating acetylene with a WELDERZ FREND as compared to bottled gas, make it the ideal generator for all-round use.
Mfd. By
WELDERZ FREND GENERATOR CO.
Lubbock, Texas

Save Material!

(MEND THE HOLE IN THE BOTTOM AND YE CAN COOK IN THE WHOLE KETTLE)

with

YORK'S 77
CAST IRON BRAZING
FLUX

1. Fear of overheating can be forgotten.
2. Cleaning and grinding are unnecessary, because "York's 77" penetrates through grease, oxides, etc.
3. Chipping is unnecessary, because a satisfactory bond can be obtained on oxidized surfaces.
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LOCKS Parts in Alignment

Frees Hands for Welding

Simply place the U-shaped jaws over the edges to be welded . . . close the toggle lever . . . this LOCKS the jaws to the work with powerful grip. The edges to be welded are brought into alignment . . . and HELD securely . . . freeing both hands for handling the welding equipment. U-shaped jaws provide excellent visibility and working space for welding. Jaws adjust to 1⅜". Made by makers of the famous VISE-GRIP Wrench.

9 in.

$2.95 EACH

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Dept. WE-10
Dewitt, Nebr.

Welded Aluminum Tanks Accepted by Underwriters

UNDERWRITERS' Laboratories, Inc., has recently issued a set of standards covering the use of flat aluminum sheet for the manufacture of welded 275-gal fuel-oil tanks.

Copies of the set, Subject 80-A, "Standards for Aluminum Inside Storage Tanks for Oil Burners," may be obtained by addressing Underwriters Laboratories, Inc., 207 E. Ohio St., Chicago 11, Ill.

These standards require that the heads and seams must be welded with a ½ in. lap or with butt welded seams. Argon-shielded-arc welding is preferred, but other methods of fusion welding are acceptable if the flux is removed by acid treatment or with a wire brush and warm water. Minimum thickness of the sheet for the head and shell has been set at 0.102 in. A minimum tensile strength of 18,000 psi is specified.

Pipe connections for fill, vent and liquid-level gauge attachments must be welded to the top of the tank. Connections for use with aluminum tanks may be either wrought or cast aluminum but must be of an alloy suitable for welding. The welded tank is required to be tested for leaks by the internal application of air pressure at 5-10 psi and an internal hydrostatic test at 25 psi.

* * *

Fabricating Firm Moves Philadelphia Quarters

MARTIN QUAID CO., alloy metal fabricators, has moved to a new location at 1815 West Sedgley Ave., Philadelphia. The firm specializes in the fabrication and production of shapes in stainless steel, aluminum, brass, bronze, copper, alloys, and other metals. Recently, the firm acquired the United States business of the Hynes Electric Heating Co., Camden, N. J., which will be known as the Hynes Electric Heating and Process Division. Lee P. Hynes, heating engineer and authority on industrial electric heating applications, heads the new division as consulting engineer.

* * *

Wartime Wing "Chopper" of Welded Magnesium

AN ALL-WELDED magnesium flying-wing built during the war was designed to slice through enemy planes without damage to itself, according to a recent issue of *Science Illustrated*. Designated the XP-79 by Northrop Aircraft Corp., the craft had two jet engines and carried its pilot in a prone position. This enabled the pilot to resist the effects of rapid pull-outs better than with conventional seating and also allowed a more streamlined design. The leading edges were armored to withstand the impact from enemy craft. The plane had a wing span of 58 ft and was 12 ft long. It was welded to achieve maximum strength.

X-Ray Machine Opens New Applications

New applications for X-ray diffraction in identification and quantitative analysis are possible with a new high-precision machine exhibited by General Electric X-Ray Corp., Milwaukee, at the recent International Congress of Crystallography.

One attachment, the fluorescent analyzer, greatly extends the range of composition of materials which can be analyzed in comparison with optical spectrometers. Another group of attachments makes possible the direct recording of X-ray intensities on a continuous strip of chart paper, saving hours of laboratory time by revealing both the angular placement of the characteristic lines of materials and their relative intensities.

The new unit is said to couple precision control of X-ray output with high intensity for the first time. The X-ray intensity is controllable to an overall accuracy of 0.5% and the tube can be operated with up to 30 milliamperes of current. High output is achieved through the use of a new sealed-off diffraction tube having three pure-beryllium windows, which are within one inch of the end and the focal spot of the tube. Tube is excited from a high-voltage transformer and full-wave rectifier rated at 50 kvp, 50 ma.

The new instrument may be used, with different attachments, for several different purposes. One of these is for the direct measurement of X-ray diffraction intensities through the use of a Geiger-Muller counter in combination with a rate meter, scaler and chart recorder. Employing a focusing crystal analyzer, the unit may be used as a fluorescent X-ray spectrometer. Thirdly, it may be employed as a conventional X-ray diffraction unit with X-ray sensitive film.

* * *

Gas Plant Changes Owners at Spokane

The Spokane Oxygen Service, Spokane, Wash., has been purchased by David J. Thomas of this city from George C. Douglas. Mr. Douglas, who plans to retire, started the business in 1925 under the name of Broadway Welding and Supply Shop.

Mr. Thomas was formerly with Linde Air Products Co. He plans to increase the company's fleet of trucks from five to eight in order to carry medical and industrial oxygen and welding supplies throughout the territory.

* * *

Airco Adopts New Packing

Air-Reduction Sales Co., New York City, has adopted a new set of orange-and-black containers for packaging of its welding torches, tips, cutting attachments, regulators and other products.

The boxes and cartons are said to permit quicker identification of Airco products, better dealer stock control, quicker inventory taking and easier handling.

A USEFUL BOOK FOR THE WELDOR

WELDING—

ITS QUESTIONS And ANSWERS

By T. B. JEFFERSON

Editor, *THE WELDING ENGINEER*

500 QUESTIONS—each answered clearly and understandably in this informative book. Answers the most important everyday questions of every man interested in welding.

Questions were carefully selected and screened from the most frequently asked by weldors about welding, cutting, materials, flame treating, inspecting, etc. Novice and expert alike can get a lot out of this book. It's easy to read, yet contains a fund of information. By using the handy index you can make this book very useful for quick answers to the questions that come up in your daily work.

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PLAIN AND ALLOYED GRAY IRON
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- ELECTRODES -
THE CHICAGO HARDWARE FOUNDRY COMPANY
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NORTH CHICAGO • • ILLINOIS

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Welding & Cutting
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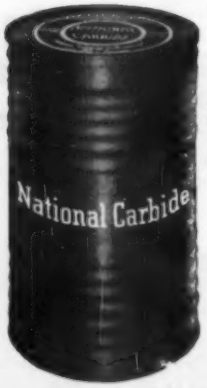

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Begin Five-Year Study of Welded Frame Strengths

STUDY of welded frames for building and bridge construction will be the subject of a five-year project assigned to the Fritz Engineering Laboratory of Lehigh University. The program, titled "Ultimate Strength of Welded Continuous Frames," will be under the direction of Dr. Bruce G. Johnston, director of the laboratory.

To be conducted at an estimated cost of $13,000 per year, the study is being sponsored by the Welding Research Council, the American Institute of Steel Construction, and the Office of Naval Research. The Column Research Council is also cooperating in a consulting capacity.

Earlier testing programs at Fritz Laboratory have suggested the possibilities of greater strength in welded frames than is indicated in present design formulas. The intensified program aims to determine the basic behavior of beams, columns, and welded frames and to develop design procedures.

In commenting on the program, Dr. Johnston explains, "In the usual design procedure the working load has a specified factor of safety with respect to the load at initial yield. The actual collapse or ultimate strength of a continuous frame may be much greater than that predicted by the elastic theory such as the Hardy-Cross moment-distribution method.

"If the real or collapse strength of a structure is divided by a specified factor of safety or 'load factor' to give the working load, a more realistic design basis and greater economy may be realized."

• • •

Gas Manufacturer Builds Plants on West Coast

INDUSTRIAL Air Products Co., Portland, Ore., has completed construction of an oxygen and acetylene plant at Spokane, Wash. The company has also remodeled and enlarged its Portland plant and is building a new oxygen and acetylene plant at Medford, Ore., to serve southern Oregon and northern California.

The Spokane plant occupies a concrete-block and masonry building 50 by 160 ft. Investment is in excess of $150,000. This plant, according to Gilbert Schnitzer, manager, will serve the "Inland Empire" area south to Walla Walla, Wash., and east to Great Falls, Mont., with direct delivery service to all points.

At Portland, the warehouse space has been increased to more than 100,000 sq ft, and the oxygen plant renovated at a cost of $150,000. The recently completed acetylene plant has a capacity of a million cu ft per month, with provisions for doubling the output.

The Medford plant will be of concrete construction and will include an office and showroom for welding supplies and equipment.

FOR
• MAINTENANCE
• PRODUCTION

You Weld Faster with a Miller A.C. Welder—the ill effect of magnetic arc blow is eliminated, permitting the use of large electrodes and high heat values.

Welding in any position—vertical, overhead, horizontal and flat—is easy with a Miller.

High efficiency transformer design reduces power costs up to 50% below comparable D.C. equipment.

Power factor correction is a built in feature on all Miller industrial models and is available at nominal extra charge on regular models.

Stop at your jobbers store today and see the Miller—use the Miller.

"For the finest in A. C. Welding Equipment—it's Miller"

miller
A. C. WELDERS
MILLER ELECTRIC MANUFACTURING COMPANY • APPLETON, WISCONSIN

Plan Pipe Line from Texas to San Francisco

PLANS for a 1,600-mile welded pipe line to bring 400,000,000 cu ft of natural gas daily to northern California from Texas and New Mexico fields have been announced by Pacific Gas & Electric Co., San Francisco.

Cost of the line will be $145,000,000 and it will be built in co-operation with the El Paso Natural Gas Co. of Texas. The line will be laid to the California-Arizona border near Needles, Calif., by the El Paso company and from there to the PG & E distributing station at Milpitas, Calif. The PG & E line, 30 to 34 in. in diam and 510 miles long, will convey the gas to northern California communities. To Needles, the gas willl be brought over two lines: a 30-in. section, 628 miles long, from the Permian Basin and a 26-in. section, 449 miles long from the San Juan Basin.

Construction is scheduled to start after necessary permits are obtained, and initial operation is planned by 1951.

* * *

Portland Section of AWS Elects 1948-49 Officers

J. H. CRUMLEY, superintendent, King Bros., Inc. was elected chairman of the Portland Section of the American Welding Society at a recent election meeting held at Camas, Wash. Other officers elected are:

john Bristow, vice-president, King Bros, Inc., vice-chairman; Wilbur C. Smith, sales engineer, Industrial Specialities Co., secretary; Charles J. Daniels, welding engineer, American Pipe & Construction Co., treasurer.

Lee Place, Air Reduction Sales Co.: H. A. Sanner, Hyster Co.; and M. D. Westover, Monarch Forge & Machine Works, were named to the board of directors for two years.

John Bristow, King Bros. Inc.: Paul Strech, Oregon Brass Works; Ed H Weil, Lincoln Electric Co.; and Paul Chatterton, J. E. Haseltine & Co., were elected to the board of directors for one year.

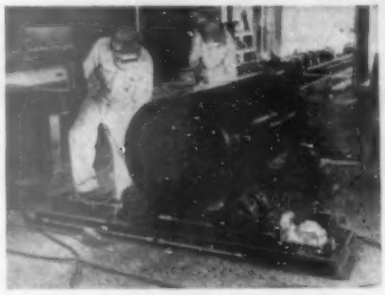
* * *

Annual Power Show to Exhibit at New York

EIGHTEENTH National Exposition of Power and Mechanical Engineering, more familiarly known as the Power Show, will be held at Grand Central Palace, New York City, from Nov. 29 to Dec. 4.

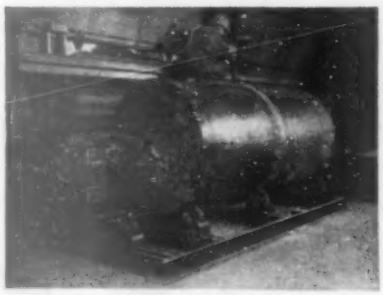
Included among the many exhibits will be a comprehensive display of refractories, stokers, steam engines, and self-contained burner-boiler units. Piping and valves, automatic recorders, controls and instruments for many uses will be shown. Improved construction will be featured in pumps and compressors, fuel and materials-handling equipment, variable transmissions and drives as well as many other kinds of power and plant machinery.

REED ENGINEERED JIGS and FIXTURES
for AUTOMATIC WELDING



PORTABLE TURNING ROLLS

These rolls are built with variable speed drive and are available in 3-ton, 6-ton, 12-ton, 25-ton and 50-ton sizes. The 3-ton unit illustrated above sells for $925.00 complete with one power and one idler unit F. O. B. factory.



UNIT TYPE TURNING ROLLS

These machines combine both power rotation of work and track support for automatic welding head into one compact unit. Five standard sizes are available for welding tanks up to 10 ft. in diameter.

LONGITUDINAL SEAM WELDER

For high production welding on longitudinal seams, the Reed Horn Type Jig has no equal. This unit combines a copper backup with a mechanical toggle linkage to press the seam absolutely flat prior to welding.

The Above Machines And Many Others Are Shown In Our New Bulletin No. 65. A Copy Will Be Mailed At Your Request.

See our exhibit at the Metal Show, Booth 718

REED ENGINEERING CO.
CARTHAGE MISSOURI U.S.A.

ENGINEERS AND MANUFACTURERS

for dependable
PERFORMANCE

"FLUXINE" Fluxes are the result of over fifty years of scientific research into the metal-joining field. There are 89 FLUXINE Fluxes . . . one for every welding, silver soldering, brazing, and soft soldering operation . . . each with its own properties, designed for a particular metal-joining operation. All have been perfected not only for highest efficiency, speed, and long life, but for economy and safety as well. FLUXINE Fluxes produce no injurious fumes to irritate eyes or nose of the operator.

Write on your company letterhead for a generous sample stating which FLUXINE Flux you desire.

KREMBS & COMPANY
(Est. 1875)
Dept. G, 669 W. Ohio St., Chicago 10, Ill.

No. 4 FLUXINE, in powder form, for welding cast iron with bronze rods.

No. 7 FLUXINE for welding all types of aluminum.

No. 18C FLUXINE for gas and atomic hydrogen welding of stainless steels and inconel.

No. 41 FLUXINE used with high-melting silver solders on copper and its alloys and on steel.

No. 42 FLUXINE used with Westinghouse Phos-Copper rods and low-melting silver solders on copper and its alloys.

No. 43 FLUXINE . . . non-glaring . . . used when low-melting silver solders are specified. No injurious fumes. Goes further than most fluxes.

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TRADE MARK REGISTERED U. S. PAT. OFF.
FLUXES TO JOIN ALL METALS

High Strength
Machinable Welds
In Cast Iron . . .

EASIER . . . FASTER . . . CHEAPER

Talk about sound, strong, machinable welds in cast iron. Here's a way to get 'em . . . *but fast* . . . every time. Use Ni-Rod* electrodes"

Ni-Rod's easy-to-control arc speeds up all kinds of cast-iron repair work. Cuts labor, time, and costs. Raises welders' success scores on tough jobs.

Ni-Rod gives you thorough fusion . . . close color match . . . smooth bead that sheds slag. Works on A. C. or D. C.

Stocked in 3/32", 1/8", 5/32" and 3/16" sizes. Order a 5-lb. package today.

*Reg. U. S. Pat. Off.

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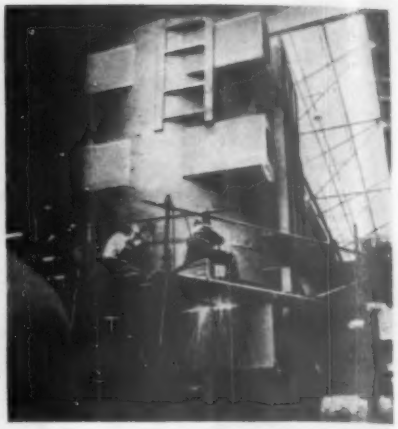
Detroit 10, 5151 Wesson Ave.	Milwaukee 4, 647 W. Virginia St.
St. Louis 10, 4565 McRee Ave.	Minneapolis 15, 529 S. 7th St.

SEND FOR FREE INSTRUCTION BOOKLET



FIFTEEN FOOT sections of 150,000-kw turbine generator stator frame are joined by arc weldors at General Electric's Schenectady turbine shop. The assembled armature, including core and windings, will weigh more than 400,000 lbs

* * *

Ryerson Holds Open House at New Oakland Area Plant

JOSEPH T. RYERSON & SON, INC., recently held an open house at its new plant in Emeryville, Calif. About 3,000 people attended from many communities in northern California.

Visitors were taken on a tour of the plant and shown its facilities for stocking, handling, cutting and shipping of steel. Dinner was served in eight dining cars of the Southern Pacific railroad, parked on sidings adjoining the plant. A tent was erected next to the plant in which refreshments and dinner were also served.

Among company officials on hand to welcome guests were Everett D. Graff, president; Robert C. Ross, vice-president in charge of operations, and Harold B. Ressler, vice-president in charge of sales, all from Chicago. Wayne D. Dukette, plant manager, was in charge of arrangements.

* * *

Russia Builds "Thermos Jug" for Molten Iron

THE Ural Machine Building Works, which builds equipment for Soviet steel mills, has in production a new all-welded fire-brick-lined carrier-mixer that holds up to 200 tons of molten pig iron for transport.

The carrier is built to serve as a giant "thermos jug" in which the iron can be kept molten from blast furnace to the open hearths for distances up to 15 miles. Enroute, the molten iron is said to suffer only the small temperature loss of 23 deg F per hour. In smaller carriers, temperature loss has hitherto amounted to more than 54 deg F per hour. Throughout its journey the mixer is rocked constantly to keep the hot pig iron uniform in structure. When loaded to capacity, the carrier weighs 333 tons.

—McGraw-Hill World News

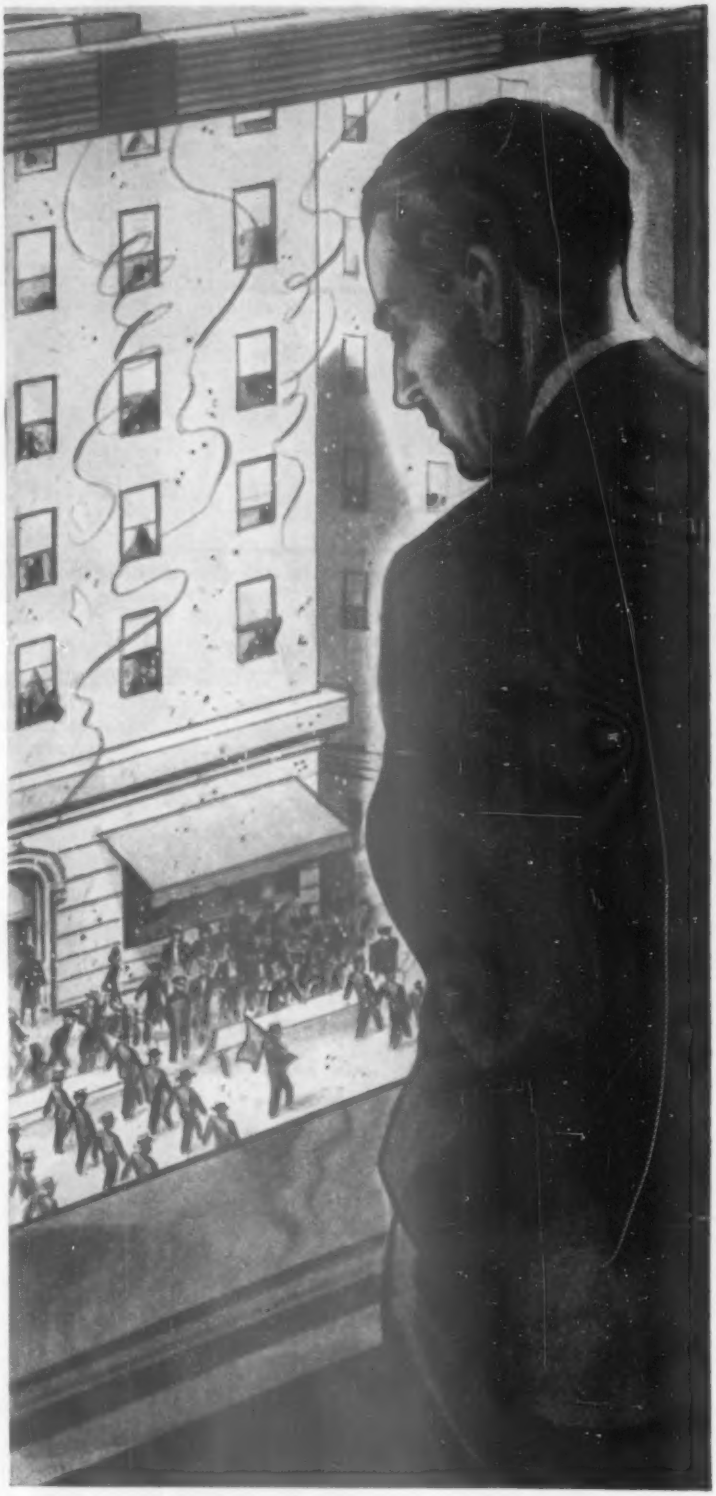
MEMO TO PRESIDENTS WHO WATCHED THE BAND GO BY!

HERE'S ONE parade that isn't "all over but the shouting" after the band has passed. It's the Payroll Savings Plan for the regular purchase of U. S. Security Bonds by employees.

Though the formal spring campaign to sell Bonds is over, any company can still move forward with the parade. Right now thousands of companies are putting *additional push* behind their Payroll Savings Plans. Managements of many companies that have not yet participated are *now installing* the Plan.

It's a "look-ahead" plan, that benefits employee, company, and nation. Every $3 invested in Bonds pay $4 at maturity. Personnel records in the plants with active P.S.P. programs show improved employee attitudes—evidenced by less absenteeism and fewer accidents—as the individual's sense of security grows with Bond purchases. And every Security Bond dollar built up in the Treasury retires a dollar of the national debt that is potentially inflationary. It means less bidding-up of prices. Moreover, Bond buyers are better citizens because they have a tangible stake in the nation's future.

It's just as easy to take action now as when the campaign was at its height. Just call your Treasury Department's State Director, Savings Bonds Division, and ask for the material that helps to get a Payroll Plan started or to keep it rolling.



The Treasury Department acknowledges with appreciation the publication of this message by

THE WELDING ENGINEER

This is an official U. S. Treasury advertisement prepared under the auspices of the Treasury Department and the Advertising Council.

Industrial and Business Papers 7 x 10 in. 100 Screen

WELDIT GASAVER

● Cuts Gas and Oxygen Cost!
● Eliminates Dangerous Fire Hazard!

With Weldit Gasaver installed the operator simply hangs his torch on the handy lever rod of the Gasaver. The weight of the torch pulls the lever rod down, closing the valves of the Gasaver, thus shutting off both gas and oxygen intake lines. The usual idle flame and needless waste of oxygen and gas between operations is thus eliminated—no fire hazard or danger of injury to workers.

When the torch is again picked up for further welding operations, the operator passes it across the pilot light of the Gasaver, thereby instantly igniting the torch at the pre-adjusted flame, ready for work—no adjustments to make.

Gasaver can be installed any convenient place on the line between regulators and torch. Most of America's largest production plants are now Gasaver equipped.

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Weldit INC. SINCE 1918

Some distributor territory still available.

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INDEPENDENT Acetylene cylinders take from 5 to 10% more gas. Uniformity of monolithic filler insures even distribution of acetone. Also Oxygen cylinders in all sizes—storage cylinders, in 12 and 20' lengths of 850 and 1500 cu. ft. capacities.

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CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN
O'FALLON, ILLINOIS

Correction

If you haven't noted it already we would like to call your attention to the interchange of captions on page 43. The picture for caption 25 is shown over caption 26 and vice versa. The same applies to figs. 3 and 4 on page 37.

The WELDING ENGINEER's production schedule prevented the corrections on pages 37 and 43.

* * *

Central Distributors Meet in Indianapolis

SECOND annual meeting of the central zone of the National Welding Supply Association was a one-day affair held at the Hotel Warren, Indianapolis, on Monday, Sept. 20. Some 38 members, associate members and guests were present.

Chairman J. N. Alcock, vice-president of NWSA, called the meeting to order, after which President Ralph E. Chase told central zone members why they needed a strong national association. To help purge the industry of unfair trade practices, to combat the prevailing trend toward reduction of margins and to educate distributors in better methods of doing business were three of the reasons he cited. As a practical example of association benefits, Mr. Chase said that the accounting system of his business, Chase Welding Supply Co., Inc., Benton, Ill., was revised as a result of what he had learned through his association contacts.

Secretary-Treasurer Robert C. Fernley told of the overhead expense report now being compiled at association headquarters to enable members to compare various items of business cost with those of other distributors. A collection service, bulletins on surplus materials and a campaign to persuade manufacturers to mention in trade paper advertising that the advertised articles are available through distributors are other current NWSA activities. Mr. Fernley wanted to know if a survey should be conducted on the methods currently being used to compensate salesmen; it was voted that this task should be undertaken.

An informal roundtable discussion of business conditions was held, at which members were asked to give the percentage increase or decrease in sales for the year to date as compared with last year and the percentage increase or decrease of their inventories. Dollar sales volume was up from 10 to 30%, but profits stayed the same or decreased. Inventories were also generally up; in one instance by as much as 35%.

A practical talk on merchandising was delivered by J. N. Alcock, proprietor of Saginaw Welding Supply Co., Saginaw, Mich. Mr. Alcock has recently moved into a new building in a downtown location and has undergone considerable expense to establish a model showroom. "It pays," he chalked in large letters on the blackboard, explaining that since he has moved into his new quarters cash sales per customer have increased 70%.

Here are some helpful hints from Alcock's experience:

Good parking facilities are a prime

necessity in a downtown location. Pull your merchandise out from under counters and out of packages; what you put out on the floor is what you sell. Good window displays attract buyers. A neat, cheerful, brightly lighted place encourages business. Put part numbers and price tags on all merchandise on display. Larger articles such as arc welders should be displayed with signs; inexpensive sign holders are available. Shake up your sales force and clerical help from time to time to get rid of the deadheads. Give a man an area he can serve properly—not more than 200 miles from the home base. Carry sales literature with you when you call on customers—and be sure your own name is on each piece. Feature new and unusual products—they give you something to talk about. Don't be a back-door salesman, or you will offend purchasing agents. The safety business goes hand in hand with welding and so do portable air or electric tools. Don't give samples away; sell them instead. Watch out for entertainment expenses.

J. W. Richards, Welders' Sales & Service, Youngstown, O., led the discussion on the topic: "Before taking on a line, should distributors check to determine whether there is sufficient volume available in their territory to compensate them for stocking and merchandising it?" The answer was overwhelmingly yes, and some felt that manufacturers should also check on a distributor's possibilities.

A. H. Homrighaus, Jr., Welder Service Co., Toledo, made an excellent talk on the distributor as the manufacturer's sales force.

After a discussion of cylinder losses and ways of avoiding them and brief comments on inert-arc welding, members adjourned to inspect premises of the Sutton-Garten Co., Indianapolis distributor, and to tour the plant of the Glenn-Roberts Co., arc welder manufacturer.

* * *

Award and Scholarship Plans Announced by Lincoln Foundation

Period for submitting entries in the James F. Lincoln Arc Welding Foundation's annual Engineering Undergraduate Award and Scholarship Program is from Sept. 15, 1948, to April 1, 1949. Current competition is the second in a ten-year series.

The program consists of two interdependent plans. Under the award plan, students submit papers on arc welding applications or technology for which 77 cash awards totaling $5.000 are made, with a first prize of $1,000.

The scholarship plan provides for awards to the institutions in which the three students winning top awards are enrolled. Department of the college in which the first prize winner is registered will receive $1,000 for four annual scholarships of $250 each. Two $250 scholarships will be given to the second place and one $250 scholarship to third place.

Complete rules are obtainable from The James F. Lincoln Arc Welding Foundation, Cleveland 1, O.

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Outstanding BUILT-IN features make Meco Safe-T-Chek Regulators the undisputed leaders in their field. *Uniform Regulation* throughout the working pressure range of the cylinder. *Built-In SAFE-T-CHEK* Valve for plus protection. *Multi-Seat Valve Blocks* for uninterrupted production on the job (where it counts). *Precision Ground Stainless Steel Valve Nozzle* for extra long life—accurate regulation. *Stainless Steel Diaphragm* for precision regulation and extreme endurance. *Continuous-Bridge Reinforcement* for super-sturdy regulator body. *Screw-Clamped Diaphragm*—free from crimps and distortion—extra safe. *Interchangeable Tank Connections*—instantly adaptable to any standard tank without disassembling the regulator. *COMPLETE Interchangeability of All Parts*—quickly and easily interchanged without special tools.

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Designed to carry the high currents necessary for intense heat, BBB Keen-Arc Carbons produce a fine-grained weld of high tensile strength. They give a smooth, steady "flowing" flame which does not wander and which is concentrated at the desired focal point. Flame temperature is easily and accurately adjusted by merely changing the ampere input, and heavy copper coating permits gripping at extreme ends—eliminates frequent and periodic re-setting.

A COMPLETE LINE OF CARBON WELDING SUPPLIES. In addition to Keen-Arcs, the BBB Line includes Carbon and Graphite Electrodes, Carbon Rods, Carbon Welding Paste and Welding Plates. Write for literature.

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Low Temperature Fluxes

Gas Saving Fluxes

SO IMPORTANT . . . . .
YET COST SO LITTLE

"Anti-Borax" Fluxes are GOOD . . . they are GUARANTEED. For best results in welding cast iron, brass, bronze, malleable iron, stainless steel, and aluminum use "ANTI-BORAX" Fluxes.

- No. 1 Cast Iron Welding Flux
- No. 2 Brazing Flux for Brass, Bronze, etc.
- No. 4 "Bras:-Cast" Flux for Bronze Welding Cast Iron
- No. 5 Aluminum Flux for Cast Aluminum
- No.8 Aluminum Flux for Sheet Aluminum
- No. 9 Stainless Steel Welding Flux
- No. 11 Tinning Compound
- No. 16 Silver Solder Paste Flux

Send for free samples

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FORT WAYNE, IND.

WITH THE NEW
HARGRAVE '41 WELDERS' CLAMP

Spatter doesn't matter with the new Hargrave No. 41 Welders' Clamp. The No. 41 Welders Clamp features a patented solid alloy screw that permanently resists spatter. Clamp has been designed with the aid of welding engineers and operators. Frame is of forged steel, heat treated for maximum strength and long life. Each clamp is *Individually Tested*. The No. 41 Regular Service Welders' Clamp is manufactured in 2, 4, 6, and 8 inch openings. Also available in Heavy Service pattern. (No. 43 Heavy Service Welders' Clamp) in 4 to 12 inch openings.

WRITE FOR CATALOG SHOWING COMPLETE LINE
THERE IS AN INDUSTRIAL DISTRIBUTOR STOCK NEAR YOU

HARGRAVE 1944 Waverly Ave Cincinnati 12, Ohio
The Cincinnati Tool Co.

About People

WALTER C. REED has established a consulting engineering office in Dalton, Mass. For 20 years he was a development engineer with General Electric Co., Pittsfield, Mass., where he helped perfect the silver-brazing process, various alloys and fluxes. He pioneered in the application of induction and resistance heating for silver brazing and soft soldering on an automatic production basis.

* * *

RICHARD J. SHERIDAN has retired as president of the John B. Astell Co., New York, warehousing distributor of welding fittings, steel pipe and tubing, boiler tubes and fittings. JOHN B. ASTELL becomes president.

* * *

J. J. TOPOLINSKI has been elected vice-president in charge of manufacturing of Skilsaw, Inc., Chicago. WALTER W. KEMPHERT has been elected vice-president in charge of sales.

* * *

HOBART C. MCDANIEL has been appointed manager, technical press service, in the public relations department of Westinghouse Electric Corp., Pittsburgh. He succeeds CARL E. NAGEL who has joined McGraw-Hill Publishing Co., New York, as editor of mail sales books.

* * *

DR. ROBERT F. MEHL, director of the metals research laboratory, Carnegie Institute of Technology, has been named chairman of the committee on ship steel of the National Research Council. He has also been appointed to the advisory committee to the Secretary of Commerce on the National Bureau of Standards.

* * *

PAUL E. THOMAS has been promoted to chief engineer of Carnegie-Illinois Steel Corp. works at Gary, Ind. He succeeds J. DONALD ROLLINS who became planning engineer of Carnegie-Illinois with headquarters in Pittsburgh. J. DOUGLAS DARBY has been elected sales vice-president of the firm. DR. R. F. MILLER has been appointed assistant to vice-president of Carnegie-Illinois research and technology department.

* * *

E. J. G. PHILLIPS, director of engineering for Richards Wilcox Mfg. Co., Aurora, Ill., has been elected president of the Monorail Manufacturers Association. A. F. ANJESKY, sales manager of Cleveland Tramrail Division of The Cleveland Crane & Engineering Co., Wickliffe, O., is vice-president and E. DONALD TOLLES, secretary.

SPOT WELDERS

BUTT WELDERS
GUN WELDERS
WELDING TIPS

Eisler manufactures a complete line of RESISTANCE SPOT WELDERS for all types of Welding. SIZES FROM ¼ to 250 KVA

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Solder and Braze Aluminum Easily and Quickly with Gas or Carbon Arc . . .

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Melting Point 732° F. Tensile Strength lbs/Sq. in. 47,300. Shearing Strength lbs/Sq. in. 45,800. Meets Air Corps Specification No. 10302. Instructions with every pound. Sizes 1/32", 1/16", 1/8", 5/32", 3/16", 1/4". Complete Assortment, and $1.00 Trial Package.

PRE-WAR PRICES

SEE YOUR JOBBER OR WRITE US FOR INFORMATION

ALADDIN
ROD & FLUX MFG. CO.
GRAND RAPIDS, MICHIGAN
Cable Address "Aladdinco"

A. C. Monteith has been elected vice president in charge of engineering and research for Westinghouse Electric Corp., Pittsburgh.

* * *

Dr. Frank Dana Carvin has been named head of the department of mechanical engineering at Illinois Institute of Technology, Chicago.

* * *

Edward H. Platz, Jr., is the new manager of alloy sales for Lebanon Steel Foundry, Lebanon, Pa.

* * *

John F. Parker has been elected president and treasurer of Iron & Steel Products, Inc., Chicago. W. J. Parker and Charles A. Marshall are executive vice-president and secretary, and vice-president and general manager, respectively.

* * *

Howard Marston has been appointed industrial manager of the Brown division of Minneapolis-Honeywell Regulator Co., Minneapolis. Earl S. Bush is the new Chicago industrial sales engineer for the steel industry for the same division.

* * *

Dr. Haldon A. Leedy has been named director of Armour Research Foundation of Illinois Institute of Technology, Chicago.

* * *

M. A. Sievert has taken an engineering position in the technical service dept., Reynolds Metals Co., Louisville, Ky.

* * *

Maj. Gen. Joseph A. Teece of Waukegan, Ill., was elected vice-president of Fansteel Metallurgical Corp., North Chicago, Ill., at a recent directors' meeting in Chicago.

* * *

Willis C. Swift, 78 Dayton, O., consulting engineer, died on Sept. 18. Surviving him are his wife and five sons. Mr. Swift was employed by the American Brass Co. for many years and was a past director of the American Welding Society. He developed the Sightfeed Generators for acetylene gas production which are now being manufactured at Richmond, Ind.

* * *

A. M. Unger, 41, research engineer of Pullman Standard Car Mfg. Co., Hammond, Ind. died on Sept. 14. He is survived by his wife and three daughters. In 1941-42, Mr. Unger was chairman of the Chicago section of the American Welding Society.

* * *

Neil C. Hurley, 78, chairman of the board, Independent Pneumatic Tool Co., Aurora, Ill., died at his home in River Forest, Ill. on Aug. 2.

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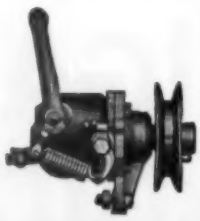

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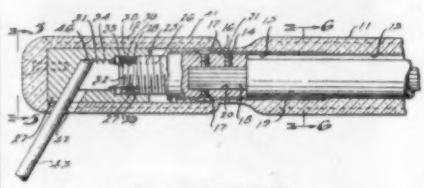
From the Patent Office

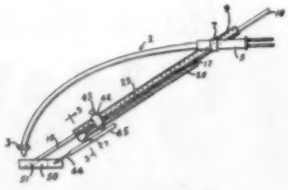


Electrode Holder

2,442,029. RUSSEL A. WELCH, Detroit. Filed April 5, 1944. Issued May 25, 1948.

An electrode holder having a terminal in its handle by which connection is made to a cable. A portion extending from the handle is provided with an external thread which has an axially disposed aperture containing a thread of the opposite hand from the external thread. A jaw having a threaded stud is screwed into the aperture of the terminal. A cap having an internal thread engages the external thread of the terminal. An aperture receives the jaw and prevents it from turning when the handle and cap are relatively rotated to clamp an electrode through the action of their threads.

* * *



Torch Guide

2,441,551. ROBERT E. ANDERSON, Champaign, Ill. Filed Mar. 8, 1946. Issued May 18, 1948.

This patent pertains to a welding torch having a hand grip and an attachment which comprises a tubular main rod connectible to the torch. A feed wheel is resiliently supported by the main rod for feeding a welding rod guided within the main rod. A carbon holder is also supported by the main rod and may be adjusted in position with respect to the welding rod.

* * *

Soldering Flux

2,440,592. KEITH KENNEDY MACDOUGALL, Chambly Canton, Quebec, and JOHN ARTHUR LABASH, Hamilton, Ontario, Canada, assigned to E. I. DU PONT DE NEMOURS & Co., Wilmington, Del. Filed Apr. 21, 1944, in Canada Apr. 29, 1943. Issued Apr. 27, 1948.

A soldering flux having an acidity equivalent to 0.15 part by weight of HCl and having substantially the following parts by weight: Zinc chloride 47; Ammonium chloride 3.5; Cupric chloride 1.0; Wetting agent 0.25; and Water 48.25.

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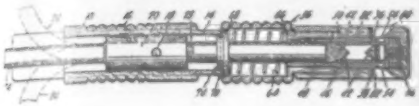
1000 S. Central Ave., Chicago 44, Ill.

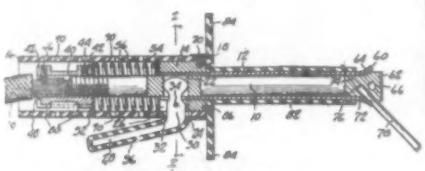
Electrode Holder

2,443,043. Clifford Laskey, Berkeley, Calif. Filed Sept. 6, 1947. Issued June 8, 1948.



An electrode holder having a shaft forming an electrical conductor. An electrode receiver also forming an electrical conductor is carried therein and has at least one aperture. An insulating cap for the receiver has at least one aperture in the wall so arranged that an electrode may be passed through this and into the receiver. An electrode-engaging member is slidably sleeved on the shaft and extends between the cap and the receiver. A trigger sleeve has a coupling connection with the electrode-engaging member. Spring means associated with the shaft and trigger sleeve urges the sleeve and electrode-engaging member in one direction to cause the latter to interrupt communication between the apertures. The trigger sleeve is movable in the opposite direction to withdraw the electrode-engaging member from between the apertures.

* * *



Electrode Holder

2,444,565. Herman J. Hecht, South Bend, Ind. Filed April 10, 1947. Issued July 6, 1948.

A welding electrode holder comprises a tube and a conductor shaft slidable within the tube. An insulating sheath encloses the major portion of the tube and shaft and includes a handle portion. A cable connector is carried by the shaft. A resilient means urges the shaft toward a clamping position. A head of enlarged cross-sectional size is carried by the end of the shaft projecting from the sheath. The outer end of the tube is enlarged and fitted around the head, which has a transverse electrode passage. This passage is at least partly intersected by the tube and positioned clear of the tube end when the shifting means is actuated.

* * *

Welding Rod

2,442,087. Edward M. Kennedy, Los Angeles, assigned to Mills Alloys, Inc. Filed Mar. 2, 1945. Issued May 25, 1948.

This is a method of making a welding rod by welding the abutting edges of a longitudinally split tube filled with a welding mixture. The surplus material is moved from the exterior of the tube adjacent the weld. The tube is subjected to axially progressive peripheral pressure to compress it, compact the mixture and close the ends of the tube.

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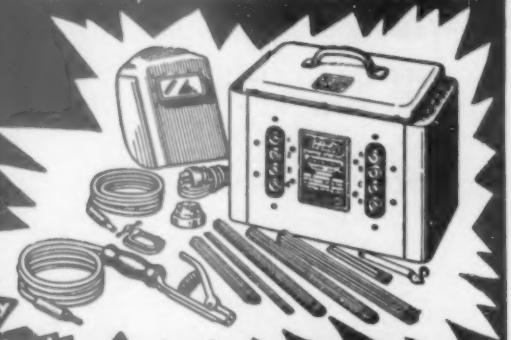

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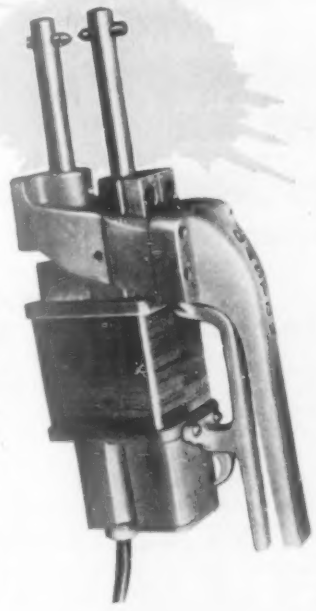

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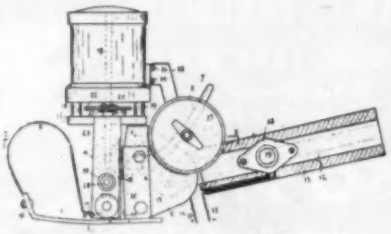
Automatic Tongs for Arc Welding

2,446,809. Camillo Cito, Uccle-Brussels, Belgium, assigned to La Soudure Electrique Autogene, Societe Anonyme, Brussels. Filed May 28, 1945 (in France, June 5, 1944). Issued Aug. 10, 1948.



Automatic tongs for manual arc welding or cutting consist of a pair of jaws, one of which is firmly mounted on a handle. A spring presses the other jaw against it. Pivoted relatively to the latter, a lever is adapted to act against the influence of the spring in order to separate the two jaws when the operator presses on the lever. Electric current is supplied to one of the jaws. A device is provided for the automatic advancement towards the work of an electrode clamped between the jaws.

* * *

Electrode Holder

2,438,990. Preston Brown, Selma, Ala. Filed Oct. 29, 1945. Issued April 6, 1948.

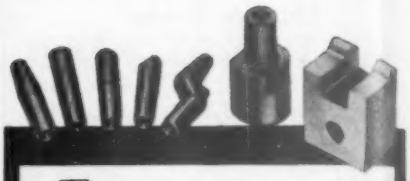
An electrode holder having an elongated hollow handle with an axially disposed bearing opening in its front end and internally threaded at its open rear end. A forwardly extending fixed shank is secured to the front end of the handle while an externally threaded bearing plug adjustably secured in the threaded rear end of the handle is formed with an axial bearing bore in its front end and an annular bearing shoulder also on the front end. A longitudinally adjustable shank has its rear end in the bore and lies adjacent to and parallel with the fixed shank. Jaws are located on the ends of the shanks with a fixed collar secured adjacent to the rear end of the adjustable shank. A trigger is secured to the shank and extends through a slot for moving shank inwardly to open the jaws against the tension of a coil spring. Tension on the jaws may be varied to effect different degrees of clamping action.

* * *

Spatter Preventive

2,446,922. Louis Grundner, Cleveland, assigned to The Lincoln Electric Co., Cleveland. Filed Nov. 3, 1944. Issued Aug. 10, 1948.

A chemical solution for preventing adherence on a workpiece of spatter from an arc-welding operation. It is applied to the surface to be protected. It consists of a resinate containing an alkali metal salt of abietic acid in water suspension having a pH not higher than 7. When the water evaporates, a thin adherent film of resinate is left on the surface.



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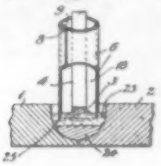
Electrode Shield

2,446,598. Henry O. Klinke, Forest Hills, N. Y., assigned to Air Reduction Co., Inc., New York City. Filed Feb. 7, 1946. Issued Aug. 10, 1948.



Welding apparatus including a metallic electrode surrounded by a tubular shield, means for supporting and feeding it toward the work and means for supplying current to it. A shielding tube surrounds the electrode and the lower end of the shield is kept below the surface of the molten pool.

* * *

Grinding Wheel

2,438,203. Leo F. Carr, Painesville, O. Filed June 11, 1945. Issued Mar. 23, 1948.

A rotary one-piece dynamically balanced abrading element of bonded abrasive material having a completely closed continuous external perimeter and a central opening in the front end. The opening is substantially square in shape and defines a continuous circumferential front end face adapted for grinding. The face consists of four uniformly peripherally spaced chordal segments integrally joined at their contiguous ends. This element has an inwardly extended back at the rear end defining an annular mounting face and underlies the corners of the opening. A wire mesh molded in the element adjacent the mounting surface is coextensive in area. A plurality of uniformly peripherally spaced screw elements is molded in the element against the inner surface of the wire mesh for securing a rotary support.

* * *

Electric Soldering Iron

2,439,296. General Arthur Hawkins, Dallas, Tex. Filed Oct. 1, 1945. Issued April 6, 1948.

In combination, a soldering tool including a copper soldering head having a pointed tip and formed with a longitudinal pocket being reduced at its front end. Glow ports extend from the pocket through the side and tip of the head. There is a mica insulating sleeve in the pocket, a metal sleeve having an annular flange on its lower end disposed in the sleeve. A carbon rod contacts the soldering head at its front end. A metal hinge yoke, superimposed metal washers disposed about the metal sleeve respectively contacts the annular flange and metal hinge yoke. Opposed clamp pins extend inwardly through the sleeves for holding it in position. A conductor connected to a shank is connectible with a suitable source of electric current supply. Tip of the soldering head, when contacting its work, serves to close the circuit with the source of current supply to heat the carbon rod and soldering head.

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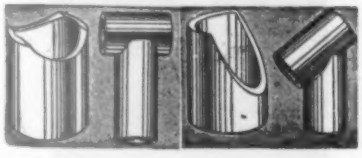

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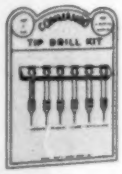

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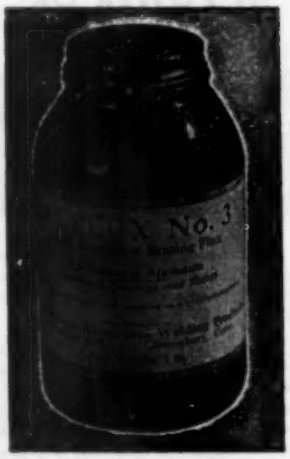

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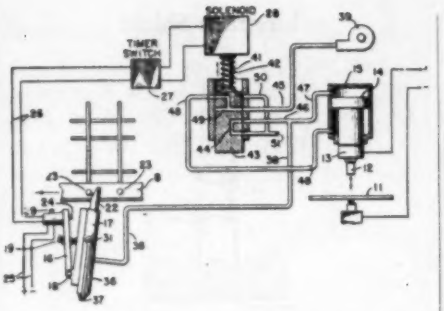

R-W Indexing Finger Control

2,446,648. Russell Millard Glantzer, Washington, Pa. Filed Feb. 21, 1947. Issued Aug. 10, 1948.

An indexing and control device for resistance welding machines consists of a member mounted for movement back and forth in a fixed path, a finger on the member and movable relative to it and means normally urging the member to its retracted position. The finger moves to a projected position for engagement by an element that moves synchronously with a workpiece. When the member is moved to its forward position, a welding electrode is energized and is operated in timed relation to movement of the work piece. The finger is automatically withdrawn from the element and temporarily held until the member has moved to its retracted position. The finger is then released for movement to its projected position.

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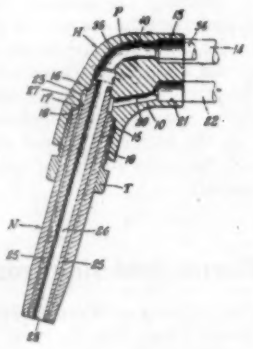

Cutting Torch

2,442,414. Wilgot J. Jacobsson, Plainfield, N. J., assigned to The Linde Air Products Co., New York City. Filed Mar. 2, 1940. Issued June 1, 1948.

For use in a torch for cutting or deseaming ferrous metal, a torch head having a cavity provided with an inlet and an outlet portion disposed at an angle to each other. The inlet portion is adapted to receive cutting or deseaming oxygen and the outlet portion is adapted to receive a metal cutting or deseaming tip. A preformed tube in the cavity has its ends fitting the inlet and outlet portions respectively and extends between them for conveying oxygen to the tip. This tube has a smooth and continuous inner surface and is gradually curved for changing the direction of the oxygen stream flowing through it.

THE DECEMBER ISSUE OF THE WELDING ENGINEER WILL CARRY A COMPLETE REPORT ON THE ANNUAL METAL SHOW AND THE ANNUAL MEETING OF THE A. W. S.